DOCUMENT RESUME

ED 059 085 SE 013 282

TITLE	Island Natural Science School.
INSTITUTION	Toronto Board of Education (Ontario).
PUB DATE	70
NOTE	135p.
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	Conservation Education; *Ecology; *Grade 6; *Instructional Materials; Learning Activities; *Manuals; Natural Resources; *Outdoor Education; Student Projects; Units of Study (Subject Fields)

ABSTRACT

Prepared for students in grade six attending the Island Natural Science School, Toronto, Ontario, Canada, this booklet offers information and suggests activities in the areas of ecology, conservation, natural resources, and outdoor recreation. Introductory material describes island lore, its formation and significant features, followed by units of study on conservation, ecology, biology, plants, animals, pond ecology, birds, bees, weather, geology, and farming. The workbook format allows students to write in answers to questions asked or note observations gained from the learning activities. General background information on the subject is also provided. Outdoor pursuits, the final unit, offers ideas for orienteering, bait casting, archery, target shooting, and survival. Follow-up activities, references, equipment lists, and general statements about ecology conclude this student manual. (BL)

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ISLAND NATURAL SCIENCE SCHOOL

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This booklet has been prepared especially for the use of pupils at the grade 6 level who spend a week in residence at the school during the year.

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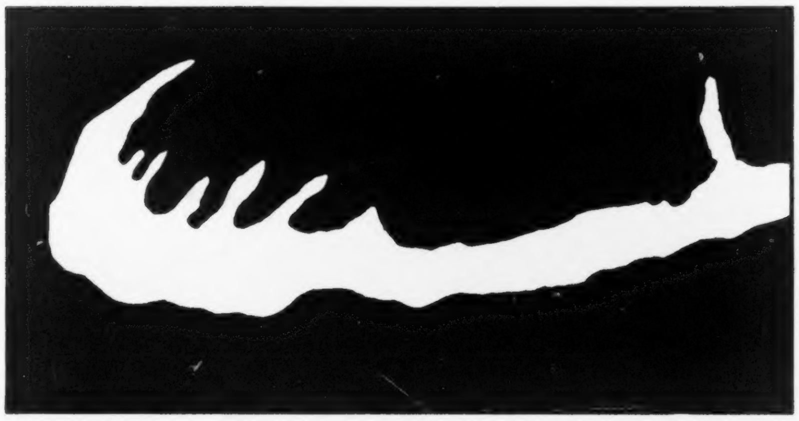
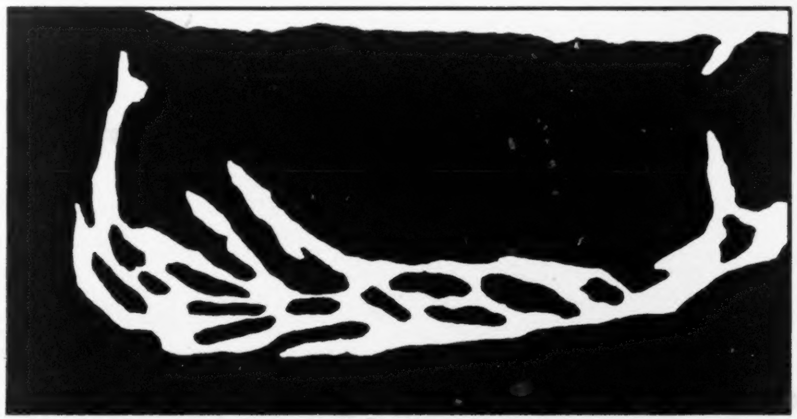
ISLAND LORE

4

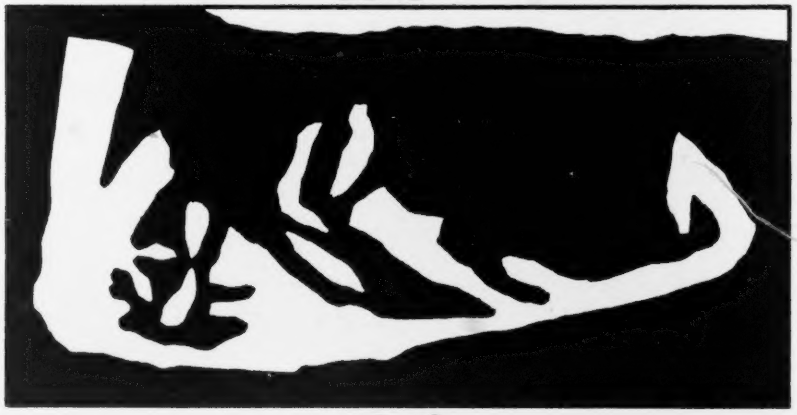
The Toronto Islands
. . . How they came to be.



1790

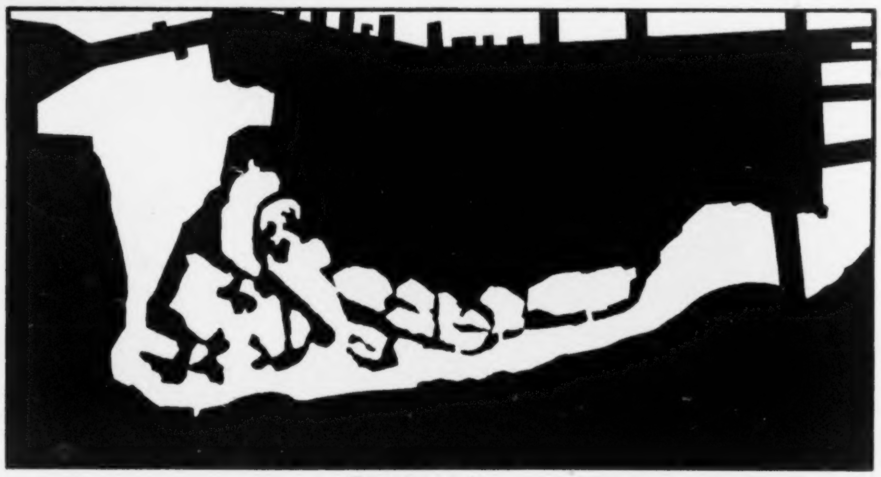


1818

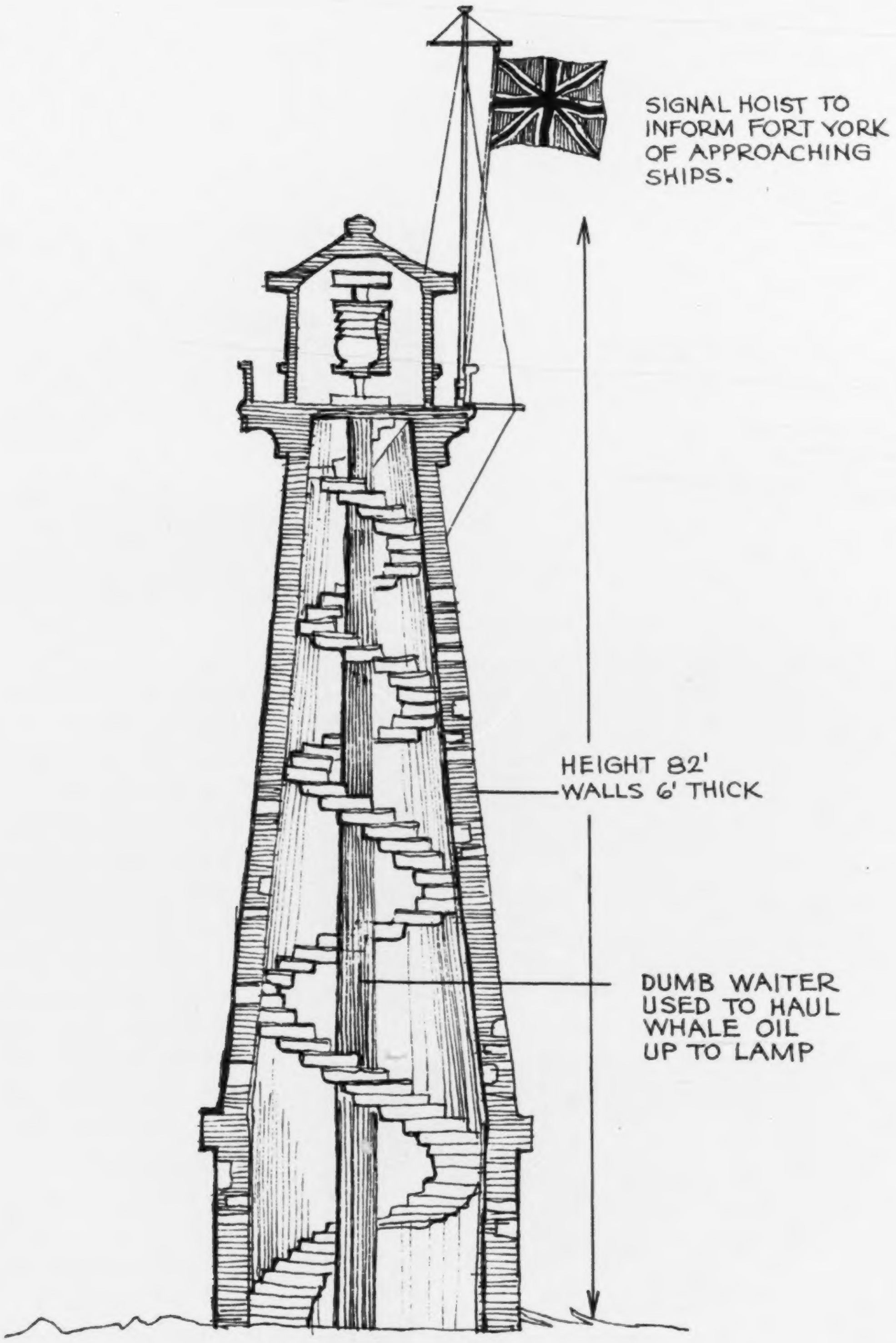


1873

Water rushes over the great falls at Niagara creating a current along the south shore of Lake Ontario. This current then curves and moves along the north shore of the Lake past the beautiful and high Scarborough Bluffs where it picks up or washes away small particles of sand and silt. Still moving along the shoreline much of this sand is deposited on the shore of the Island. In the past 150 years about 2 feet has been added to the shore each year. When the lighthouse was first built it was about 25 feet from the shore, now the shore is nearly 300 yards froms the lighthouse. Now that the Island is being made into a park many of the shores are being permanently formed by pilings. Notice how the west shore has been shaped by the west wind. Come back again and see how the Island has changed.



TODAY


SIGNAL HOIST TO INFORM FORT YORK OF APPROACHING SHIPS.
HEIGHT 82'
WALLS 6' THICK
DUMB WAITER USED TO HAUL WHALE OIL UP TO LAMP

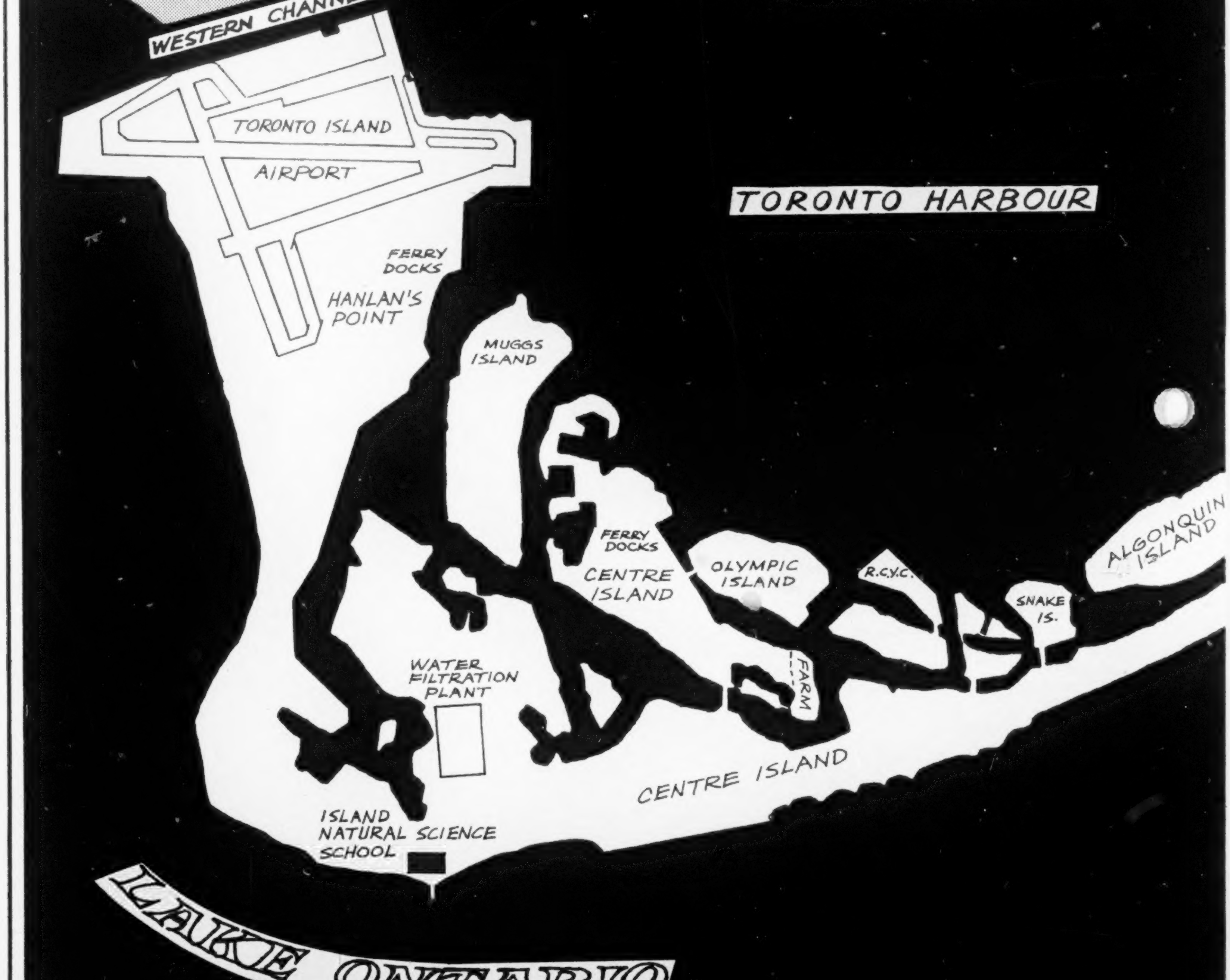
The Lake Light

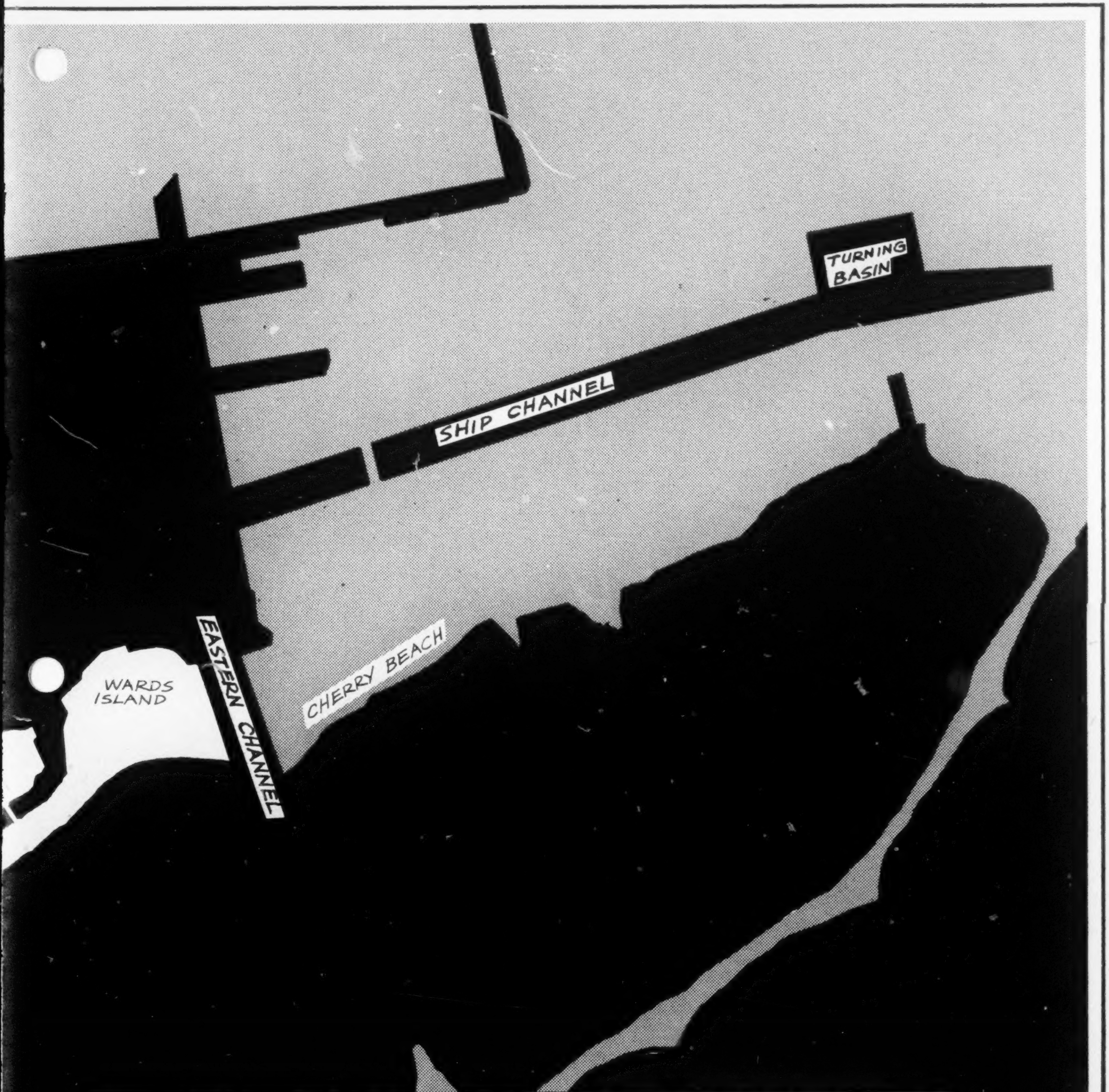
A plaque on the lighthouse, erected by the Ontario Archaeological and Historic Sites Board, reads:

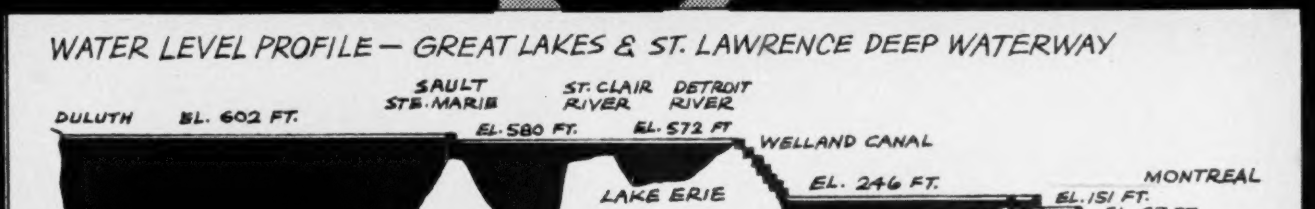
The Island Lighthouse

This lighthouse, one of the earliest on the Great Lakes, was completed in 1808 as an hexagonal tower 52 feet high, topped by a wooden cage with a fixed whale-oil lantern. In 1832 it was raised to 82 feet and later equipped with a revolving light. The mysterious disappearance of its first keeper, J. P. Rademuller, in 1815 and the subsequent discovery nearby of part of a human skeleton enhanced its reputation as a haunted building.

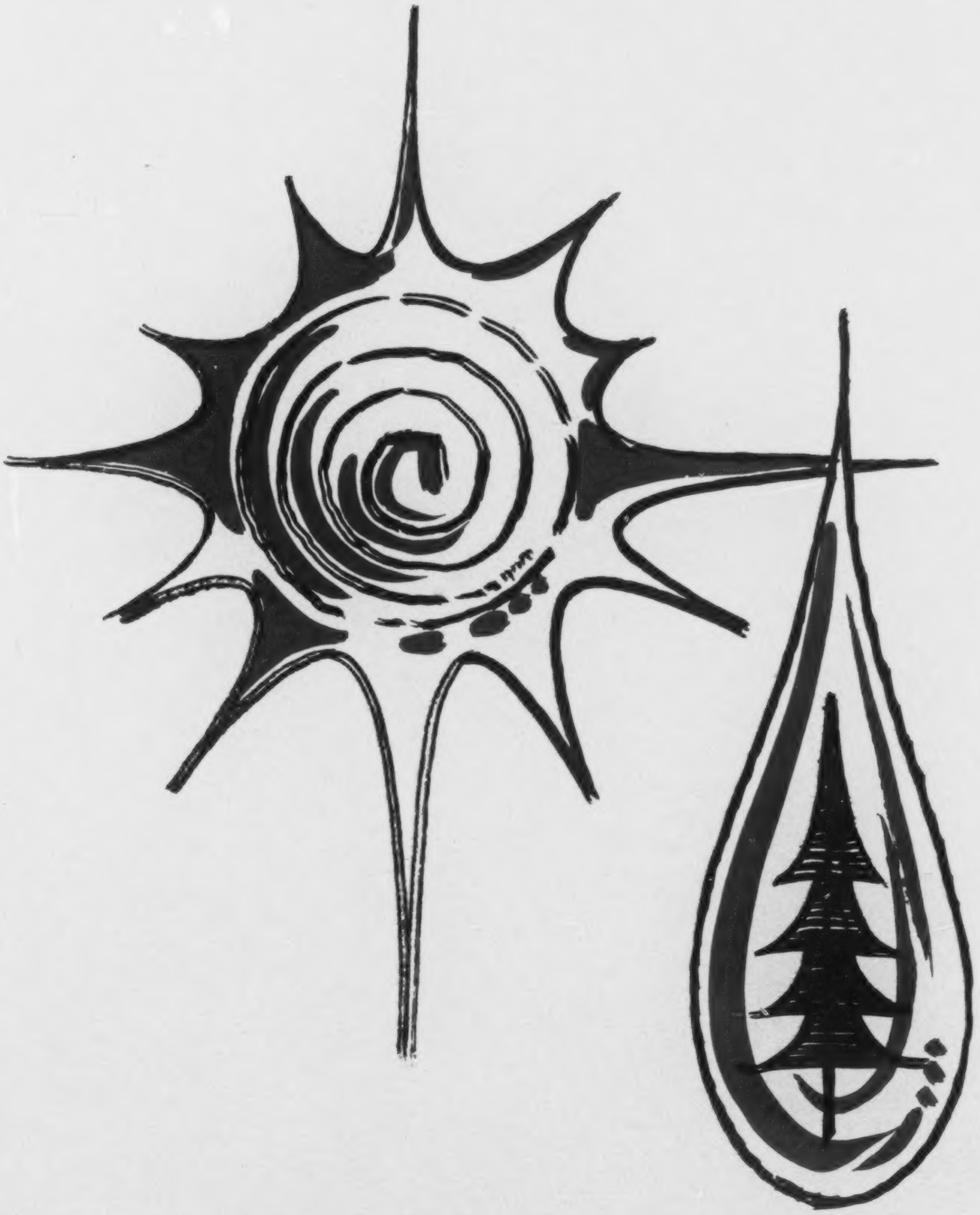
Map of
Toronto
Island


WESTERN CHANNEL
TORONTO ISLAND
AIRPORT
TORONTO HARBOUR
FERRY DOCKS
HANLAN'S POINT
MUGGS ISLAND
FERRY DOCKS
CENTRE ISLAND
OLYMPIC ISLAND
R.C.Y.C.
ALGONQUIN ISLAND
SNAKE IS.
FARM
WATER FILTRATION PLANT
CENTRE ISLAND
ISLAND NATURAL SCIENCE SCHOOL
LAKE ONTARIO


TURNING BASIN
SHIP CHANNEL
EASTERN CHANNEL
CHERRY BEACH
WARDS ISLAND


WATER LEVEL PROFILE — GREAT LAKES & ST. LAWRENCE DEEP WATERWAY
DULUTH
EL. 602 FT.
SAULT STE. MARIE
ST. CLAIR RIVER
DETROIT RIVER
EL. 580 FT.
EL. 572 FT.
WELLAND CANAL
LAKE ERIE
EL. 246 FT.
MONTREAL
EL. 151 FT.
EL. 67 FT.
EL. 22 FT.
MEAN SEA LEVEL
LAKE SUPERIOR
LAKES MICHIGAN & HURON
LAKE ONTARIO
LAKE ST. FRANCIS
LAKE ST. LOUIS

CONSERVATION



CONSERVATION

Conservation is the wise use of nature's material. Man's welfare is dependent on healthy plants. In turn, plants of good quality depend upon fertility and texture of soil. Some of nature's materials (natural resources) are: plants, animals, soil and water.

Soil originated from rocks. Nature's ways of turning rocks into soil are called weathering. The weathering ways of nature are aided by:

(a) rivers, water falls, rapids.
Examples: Grand Canyon and Niagara Gorge.

(b) wave action along the beaches

(c) glaciers

(d) avalanches

(e) wind

(f) temperature changes

(g) roots of plants.

As different coloured rocks weathered they formed different coloured soil; the farmer looks to the texture to name the soil. We have two main soils in this area. (a) Sandy soil from weathered hard rocks. This soil absorbs water rapidly but the water evaporates quickly. It doesn't hold moisture for the roots of plants very well. (b) Clay soil from weathered limestone. This soil absorbs the water slowly but holds the water for the roots of plants. The best soil is a combination of the two, clay and sand.

If you dig a hole in the ground you will notice that the soil has different colours. The dark soil on the top is called top-soil. The lighter soil under the top soil is called sub-soil. Nature made the dark top soil by adding decayed plant and animal remains. This rotted material is called humus or organic matter. Bacteria, fungi, insects and other small animals attack the dead things in nature and turn it into humus. All life is dependent on this organic matter.

Clothing: cotton, linen, wool, silk, rubber, etc.,

Shelter: wood. All our *food* is derived from the soil.

Nature makes top-soil very slowly. It takes between 500 to 1,000 years to make one inch of top-soil. When the first settlers came to North America there was an average of nine inches of top-soil. Today we have six inches of top-soil. Where has this three inches of top-soil gone? The rains and floods have washed it off; in dry weather the winds have blown it away. This process is called erosion. It did not happen before the coming of the settlers because then large parts of North America were covered by forests. The forests help soil by covering the ground with leaves. When the leaves decay they form humus. Also the branches of the trees and the leaves break up the bombing effect of the rain drops. The humus acts as a sponge in holding the rain water. Trees and other plants keep the wind from blowing the top-soil away. If the forests were so important to the fertility of the soil why did the early settler cut down so many of the trees? (a) He needed open fields for his crop and grazing land. (b) He needed the wood for building, fuel, furniture, tools, etc. With the clearing of the land of trees and other plants the soil was exposed to erosion by water and wind.

When man learned his mistake he tried to help the soil in many ways.

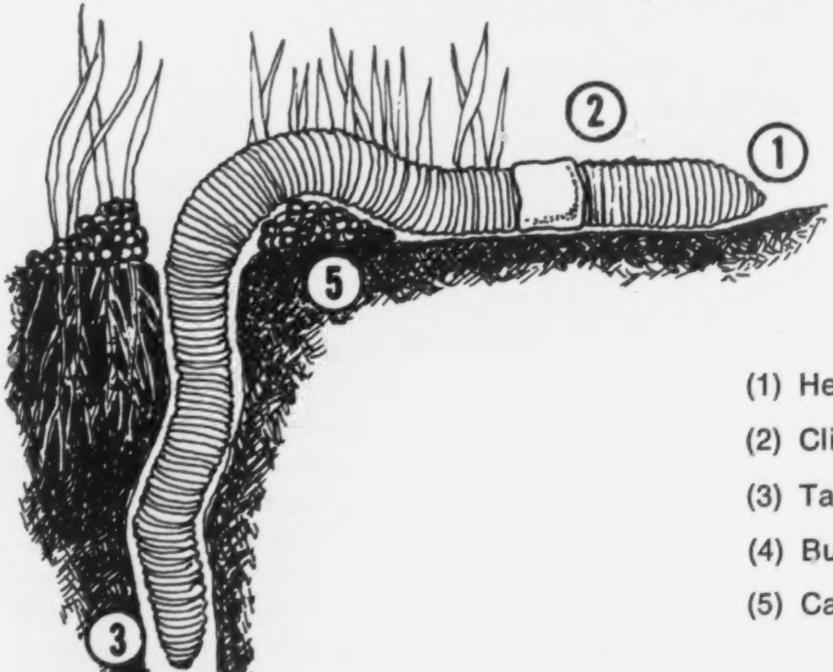
(a) **Contour plowing:** By making his furrows go across a grade he made a series of steps that would hold the rain water and save the top-soil.

(b) **Contour or strip planting:** Rows of open plants like wheat, oats, rye, etc. interspersed by cover crops of clover, alfalfa, etc.

(c) **Mulching:** On open ground or sandy soil a layer of straw, leaves, wood chips, etc. is spread. This covering layer of material breaks up the falling rain drops; keeps the water from evaporating so quickly; keeps the wind from blowing seeds away; protects the roots of plants from washing away. It becomes humus itself in time.

(d) **Compost piles:** There are many different kinds of compost piles. A farmer's manure pile is one kind of compost; man makes many other types. He may use various materials such as, grass clippings, leaves, manure, table scraps mixed with soil. Bacteria slowly turns this organic material into humus.

Worms help the soil and speed up the decomposition of material in the compost pile. Most people think of worms in terms of fishing; they are strange little animals that are most important to man. They are a long hollow tube formed by two sets of muscles used for motion. As a worm burrows through the earth he pushes some of the material into his mouth. Any plant or animal material in the earth is digested by the worm. At the same time the worm adds nitrogen from his own body. A worm's castings are an excellent food for plants. While burrowing he mixes top-soil and sub-soil. The burrows of the worm aerate the soil. The burrows help absorb water when it rains which helps to feed the roots of plants.



(1) Head
(2) Clitellum
(3) Tail
(4) Burrow
(5) Castings

If we wish to help the compost pile with worms we should use the worm capsules that hold the eggs. The worm capsule is formed by the clitellum or band on the worm. After mating the band works off the worm and is deposited as an olive green object about the size of a grape seed. The more worms there are in the compost pile, the faster the material is decomposed.

FOLLOW-UP ACTIVITIES

1. What is conservation?

____

____

____

____

2. Name four of nature's materials.

a.__________ b.__________ c.__________ d.__________

3. Name some of the ways in which nature has weathered the rocks.

____

____

4. Name two types of soil by their colour.

a.__________ b.__________

5. What is humus or organic matter?

____

____

____

____

____

6. How is humus formed?

a.__________ b.__________ c.__________

7. How is life dependent upon the top-soil?

____

____

____

____

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8. Why is it that we have less top-soil today than we did many years ago?

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____

9. Why did the early settlers cut down so many trees?

____

____

____

____

10. How do the forests help the top-soil?

____

____

____

____

11. Name three ways that man helps the top-soil.

a.________________ b.________________ c.________________

12. How do worms help the soil?

____

____

____

____

13. How should we add worms to the compost pile?

____

____

____

____

ECOLOGY, BIOLOGY, PLANTS, ANIMALS

ECOLOGY, BIOLOGY, PLANTS, ANIMALS

Although the world may seem quiet and stable, it is in fact changing every moment. A drama of life and death is being acted out: plants are growing, flowering, producing seeds and dying; animals are finding food and hiding from enemies; old stumps are crumbling to become soil for new plant life.

Just since you have started school you have been able to see how much Toronto itself has changed. Your parents and brothers and sisters are growing and changing daily, and so are you. You were born as a human baby; and your family is now caring for you, providing food and shelter. You are also learning how to provide for and protect yourself. When you are a little older, you will have your own young to care for and shelter. It is in this way the growing, living, reproducing and dying processes of all life form the basis for all biological sciences.

The word 'biology' is derived from Greek *bios,* meaning 'life' and *logos* meaning 'study of'.

If you were a pioneer choosing a place to build a home in the woods what things would you look for?

1. ________________________________

2. ________________________________

3. ________________________________

You would have to choose a place which would satisfy all of your needs. Think about your ideas and needs and apply them to other animals and plants. They tend to live in places which satisfy their needs as well. All living things, whether plant or animal, have three basic problems to solve in order to live.

1. Nutrition, the getting and using food for energy and growth.
2. Protection from weather and from enemies.
3. Reproduction, to keep the species alive; young plants and animals are produced and replace the old as they die.

HOMO SAPIENS (man)

As human animals, we can use the environment in many ways. We can live on the water, on the land, or in the air. We can survive in very cold climates and in very hot climates. We can eat plants or other animals to survive and we can sit back and study the world because of our ability to think scientifically. But we are just as dependent on plants and other animals for life as they are on one another and on us. Without the plants and animals, and their products, which we use for food and shelter, we could not exist in our environment.

Think back to your house in the woods. How would you rely on trees for survival?

Do you rely on trees in the city?

How hot would it be if there were no trees or shrubs?

What other plants or animals do we need to help us stay alive?

	Why?
1.	
2.	
3.	
4.	
5.	
6.	
7.	

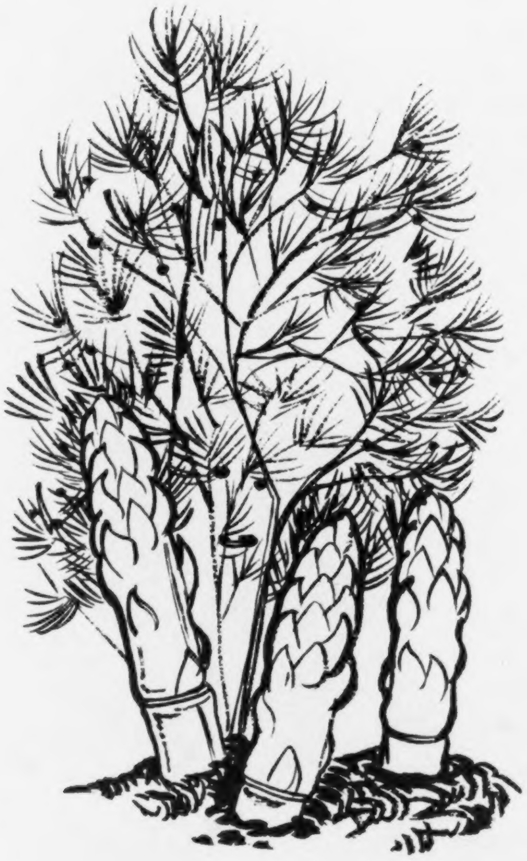
"All living things rely on one another and are related."

You will notice as you walk quietly, listening and watching in the world of nature, that you become so much a part of the out of doors that you can see, hear and smell the drama of the woods.

Walk softly and discover a new world.

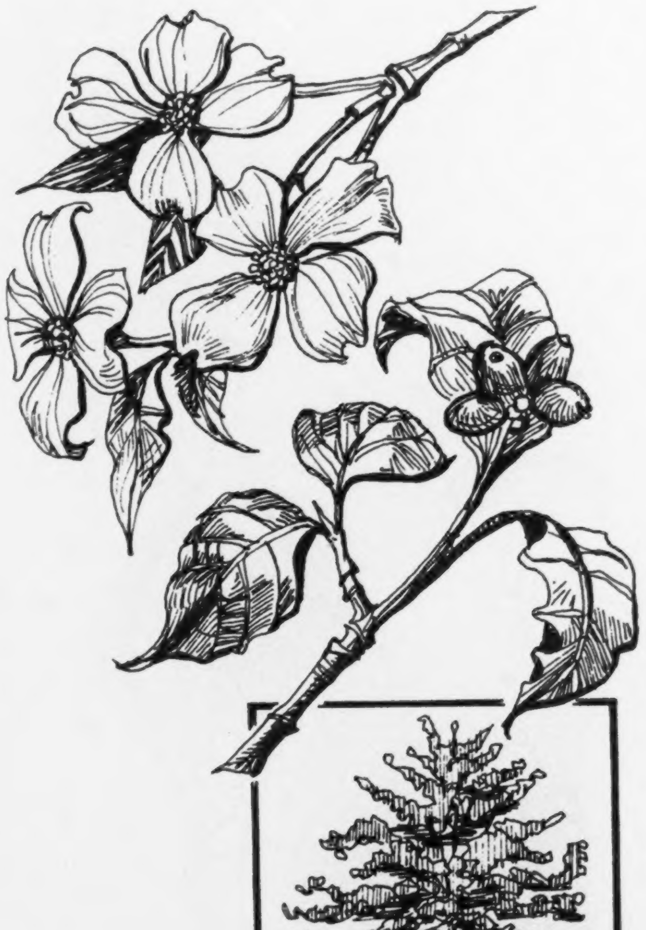
To keep a record of the things you see, make sketches, take photographs and try to find out more about the world around you.

PLANT LORE



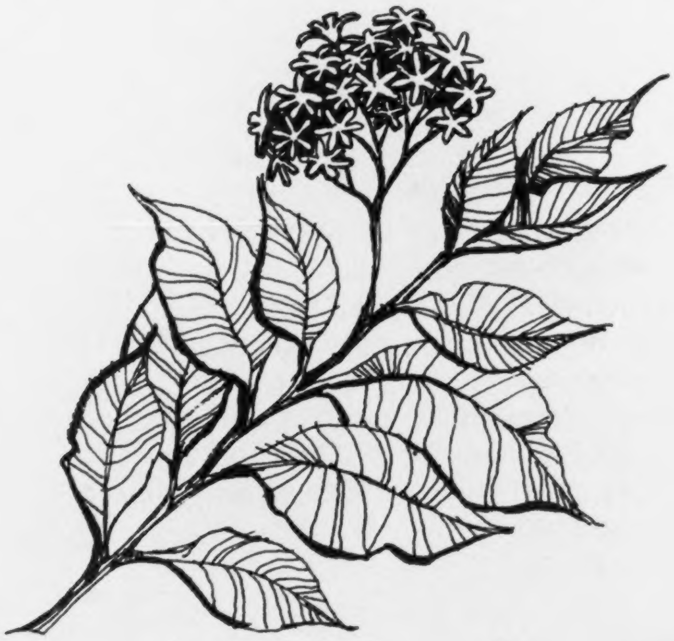
Asparagus

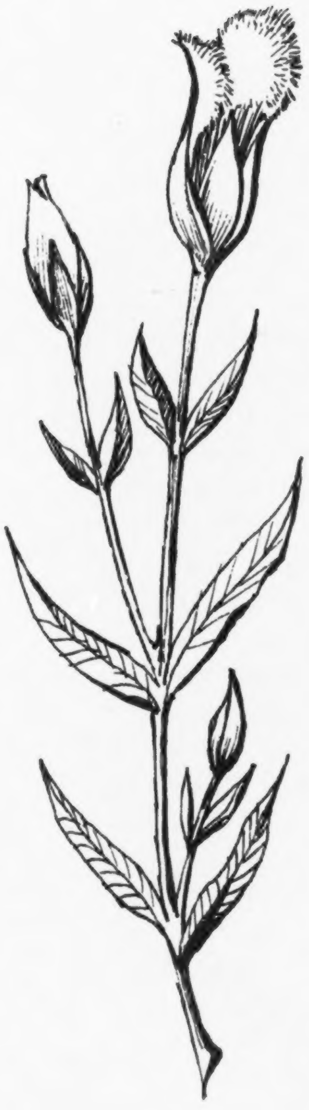
Asparagus is a plant food which belongs to the lily family. Man, after discovering that the stalk of the plant was edible, transferred it from the woods (where it may still be found) to his garden. The stalk of the asparagus grows in scaly spears. These scales are actually degenerate leaves. The green thread-like branches function as leaves in the manufacture of food. The flower is small and green. There are male and female stalks. The female is longer.



Dogwood

Dogwood is the one shrub on the Island that is easily recognized in any season because of the red colouring of its bark.



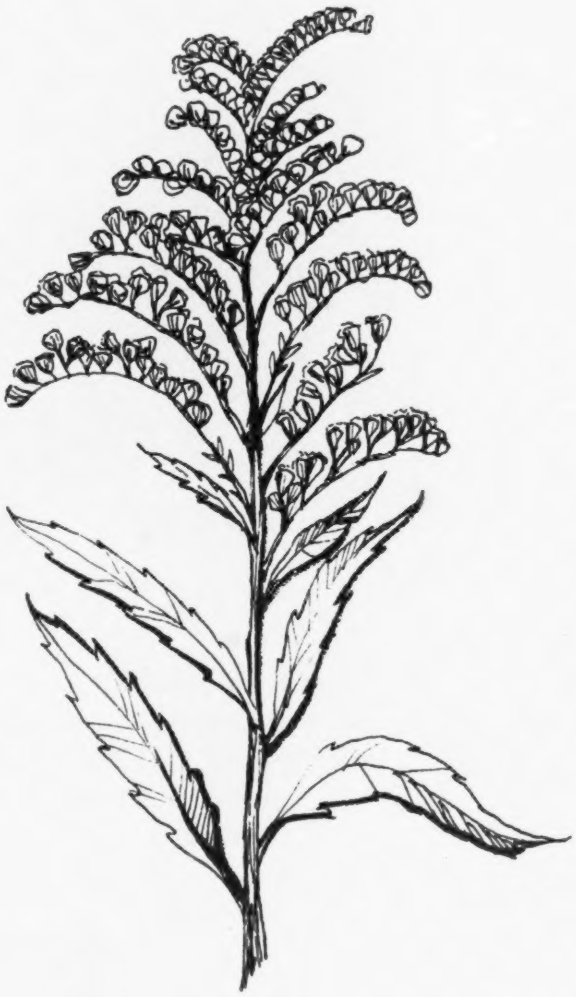


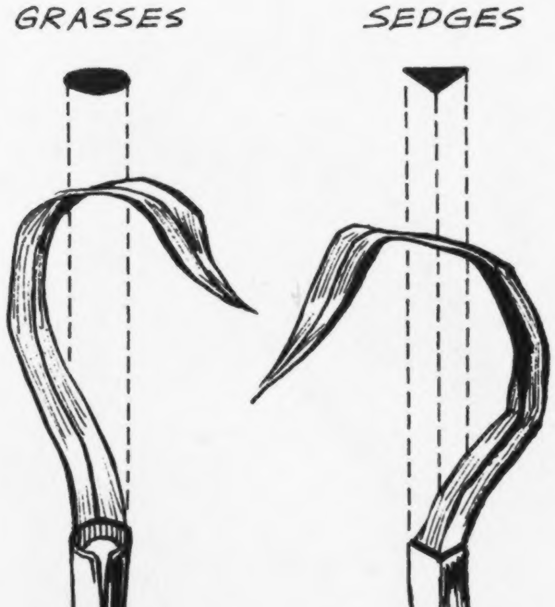
Fringed Gentian

You will find this deep blue flower in moist areas in the woods or by marshes. It grows one or two feet high, erect from the root and flowers, in late summer or early fall. Gentian roots are used medicinally as a tonic.

Goldenrod

Although goldenrod is often blamed for causing hay fever, its pollen is too heavy to be carried by the wind. The sticky blossom, however, collects the pollen from other irritating plants and in this way does cause hayfever. In winter, goldenrod is noticeable because of the gall which is an enlargement or swelling on the stem. The gall fly lays an egg in the stem and the gall is the home of the larva until the insect either becomes lunch for an industrious bird or emerges in the spring.





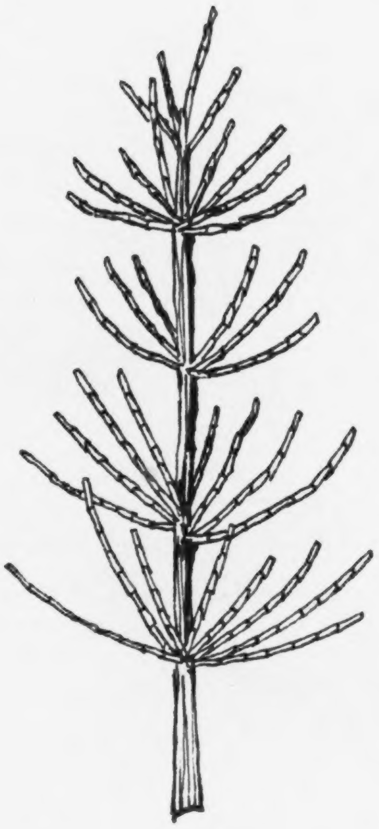
Grasses and Sedges

It would take a complete book to write about all the different kinds of grasses that we can find and cultivate. Grass has a hollow, jointed stalk with narrow leaves called blades. The seed of grass is similar to that of grain.

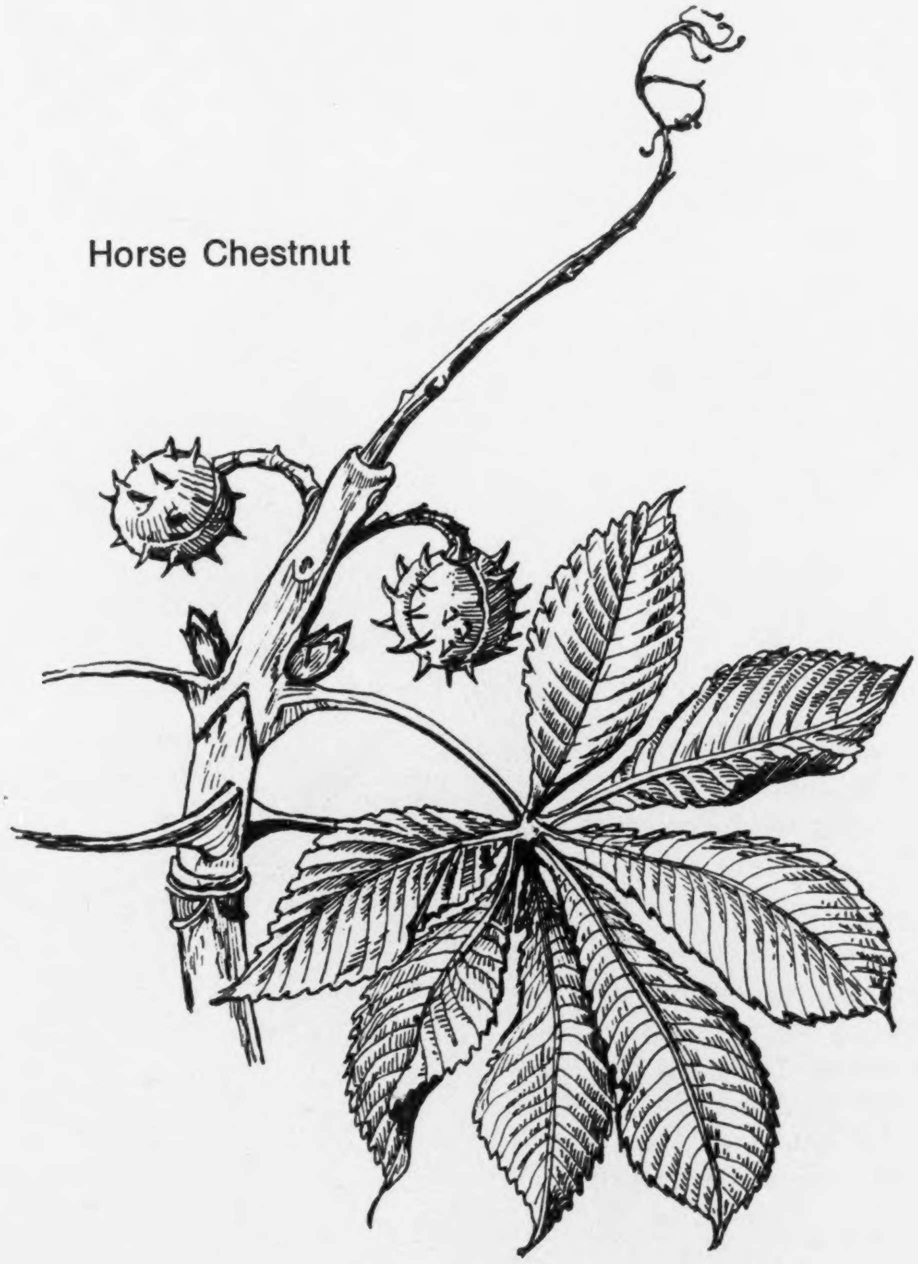
Sedges are grasslike or rushlike herbs that grow in damp places. They differ from grass in that they generally have solid stems rather than hollow ones.

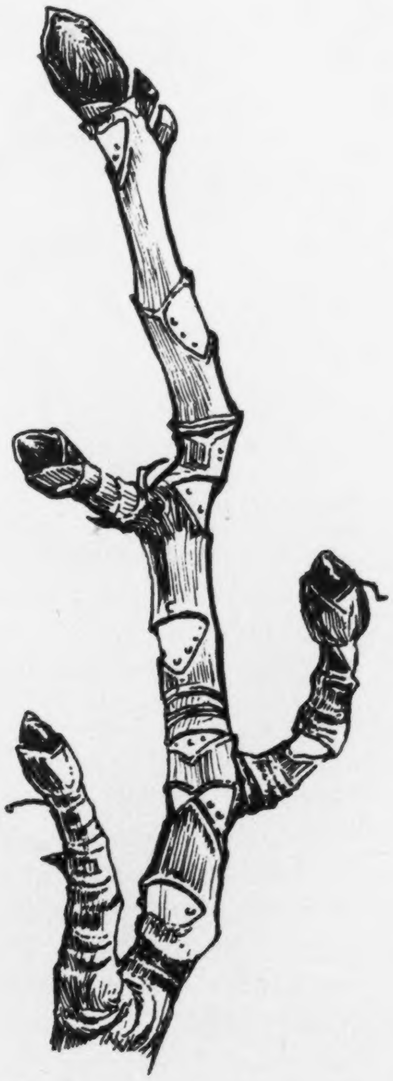
Horsetail

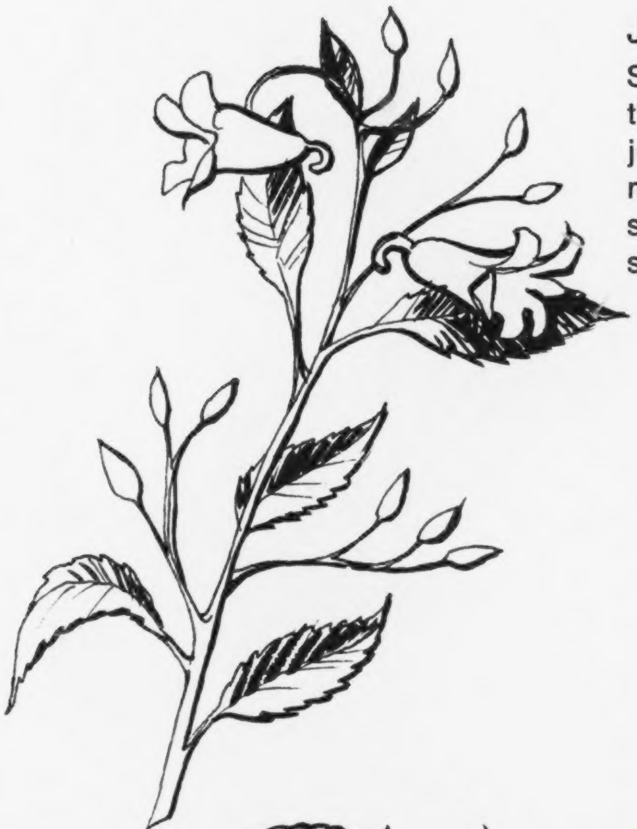
One of the early signs of spring is the horsetail. Growing from an underground stem, it pushes its way up through gravel and cinders producing two different looking stalks in each season. They are a very pale flesh-coloured stem which is hollow with sections fitting together like pieces of a pipe. The flat black teeth that surround each joint are remnants of leaves, useless for food-making. Food comes from a store in the underground stem. The only purpose of the stalks is to produce spores. When the spores are ripe the stalks wither and the food-making stalks appear. They are bushy plants which resemble brushes.



Horse Chestnut





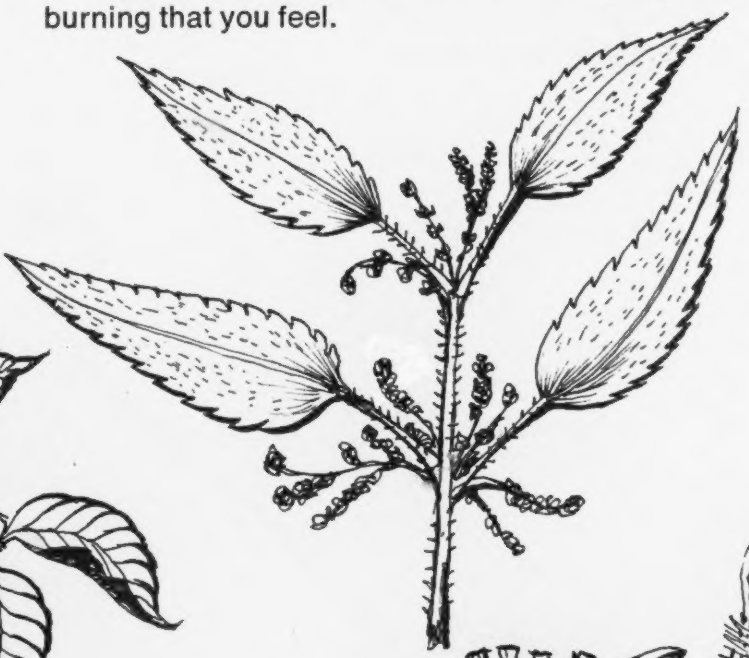


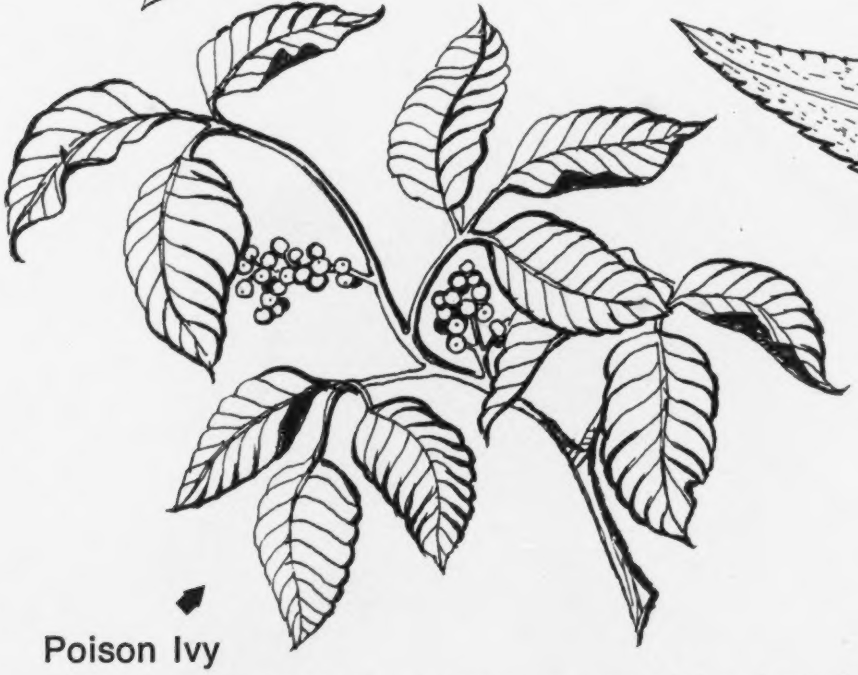
Jewel Weed

Sometimes called touch-me-not (because when the ripe seed pods are touched, they explode) the jewel weed is an interesting flower that thrives in moist, shady areas. The sap of the jewel weed is said to relieve the sting or itch of poison ivy and stinging nettle.

Nettle

If you take a hand-lens and look at the tiny spines along the leaves and stem of stinging nettle, you will be able to see the hairs which are filled with a type of acid. These hairs, when broken in contact with your skin, are what cause the itching and burning that you feel.



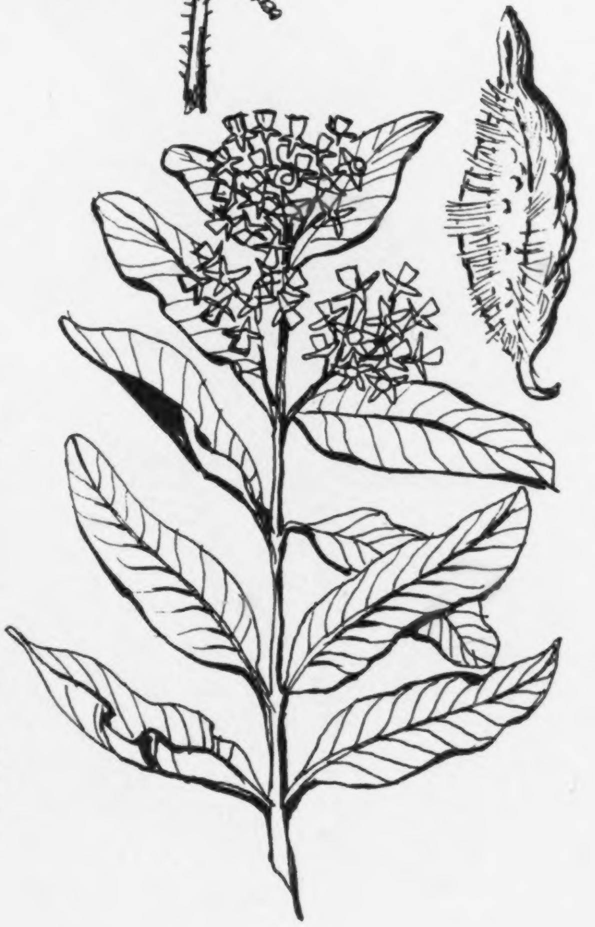


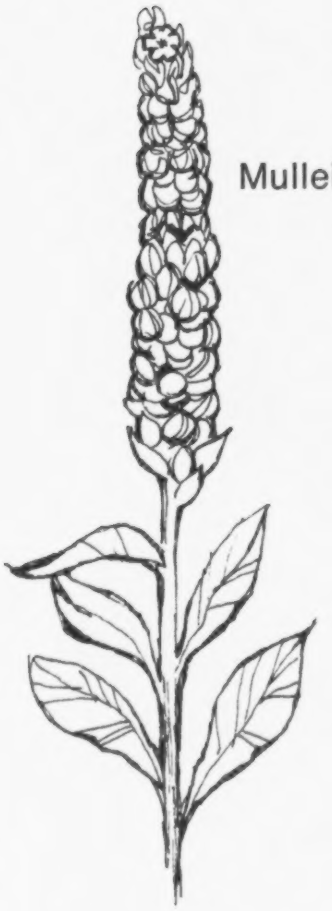
Poison Ivy

There is an oil present in almost every part of the plant which can cause watery blisters to form on your skin within hours after contact. Even a breeze blowing over the plant and touching you can cause irritation.

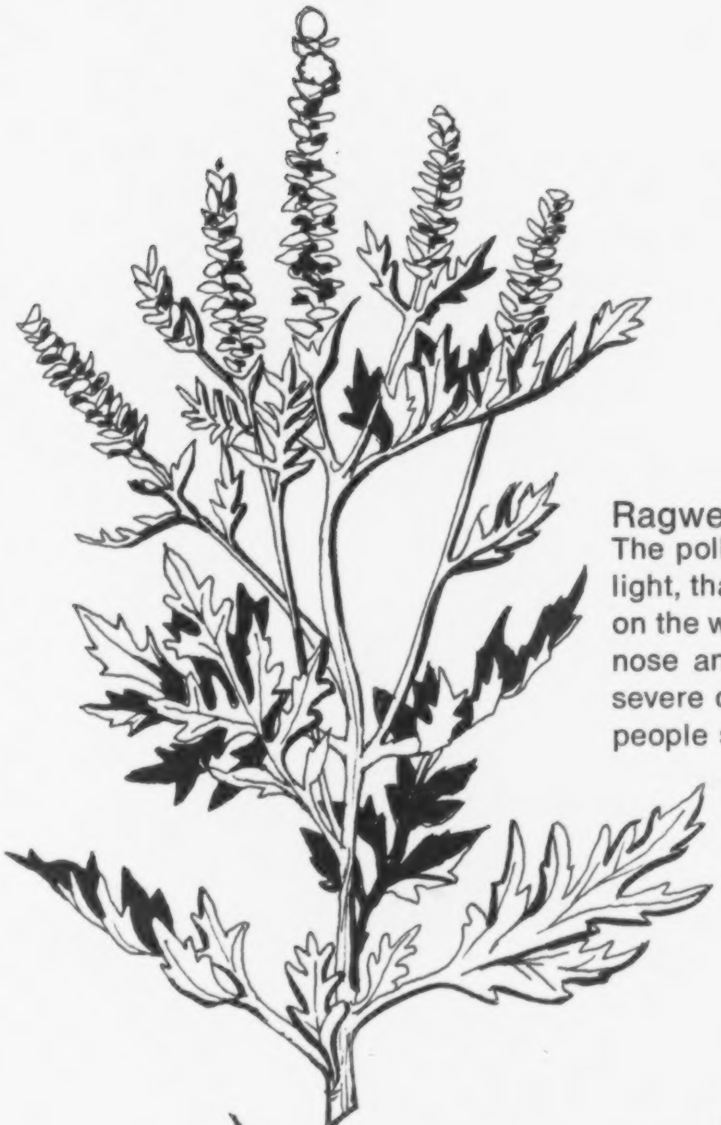
Milkweed

Milkweed produces a special secretion which is very bitter and is a protection against nibbling animals. This milky latex is what gives the plant its name. The seed pods dry in the fall and release the silky fluff parachute seeds to be carried by the wind. During World War Two these seeds were collected and processed for use in life jackets and flying suits.



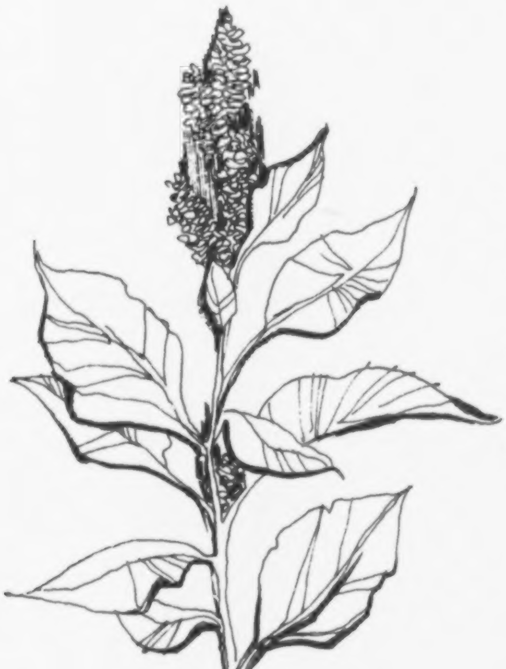


Mullein

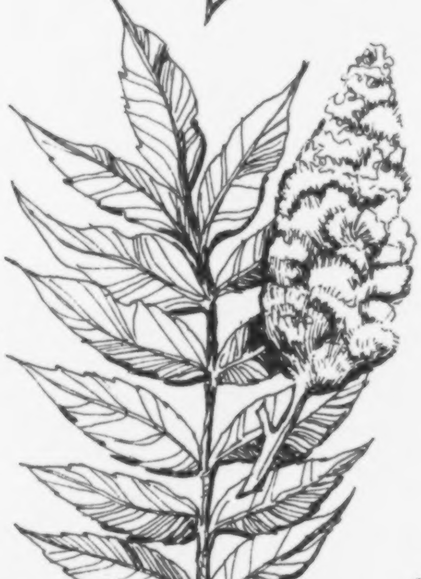


Ragweed

The pollen of this plant is so light, that it can ride for miles on the wind. It sticks to eyes, nose and throat and causes severe cases of hay fever for people sensitive to it.

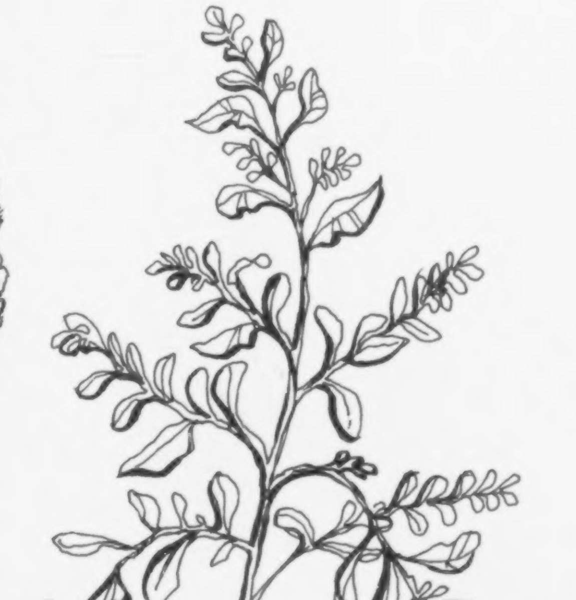


Retroflexus



Sumac

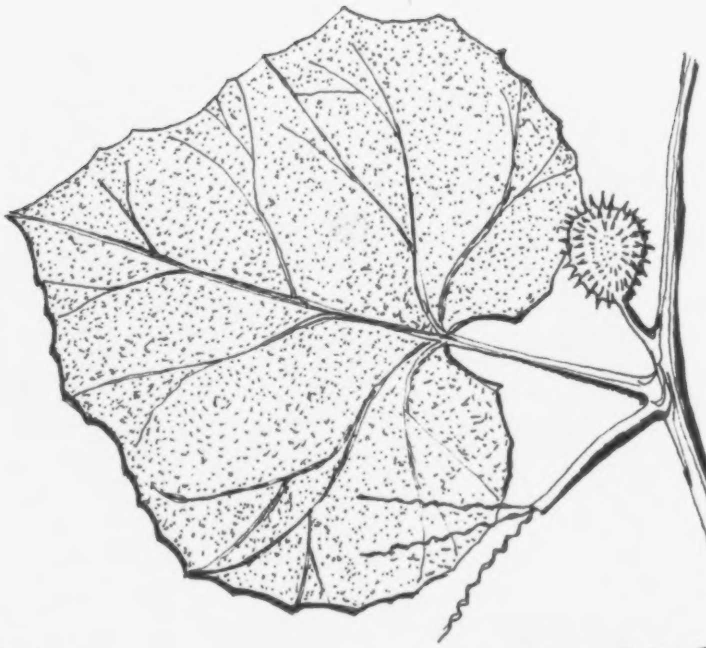
The Staghorn sumac has soft velvety branches much like the antlers of a young stag. The fruit is a cluster of soft, velvety red or maroon seeds.



Tumbleweed

Wild Cucumber

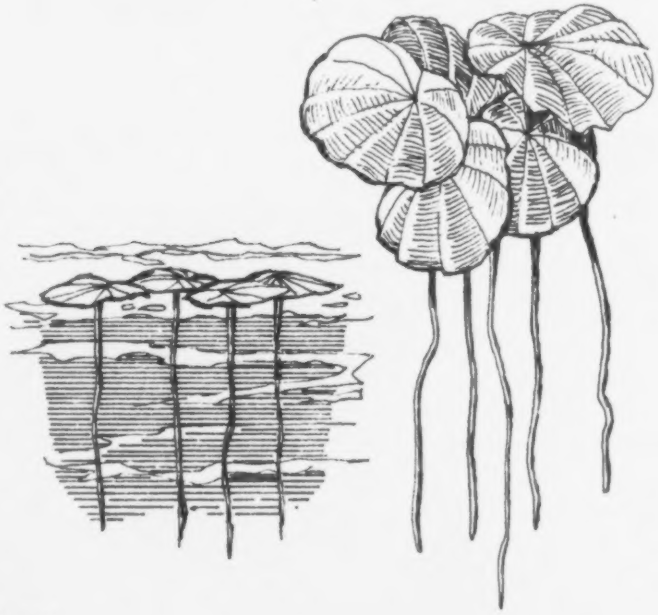
This plant grows on a vine. It seems to be fairly prevalent on the Island because of the sandy soil. It can be found growing in many areas in the city.

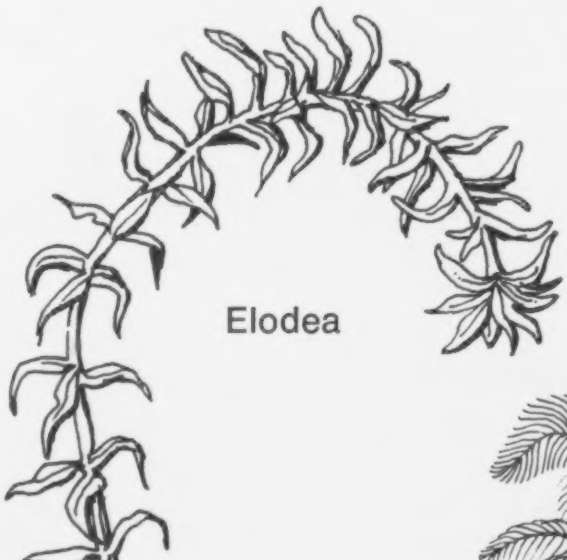


POND

Duckweed

By mid July, millions of tiny disc-like plants will be covering the pond. These are the smallest flowering plants known to man. The roots dangle in the water from which the duckweed gets all the nourishment it needs.

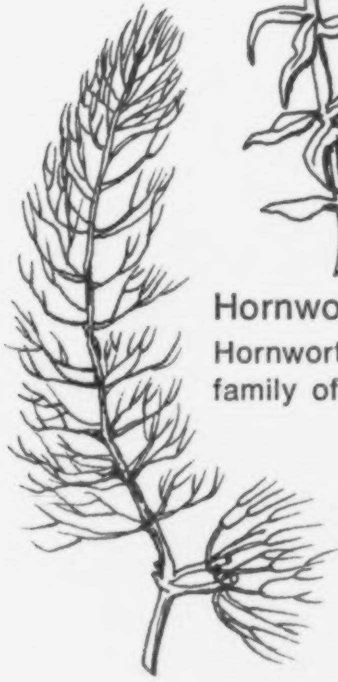


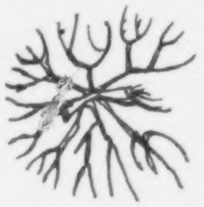


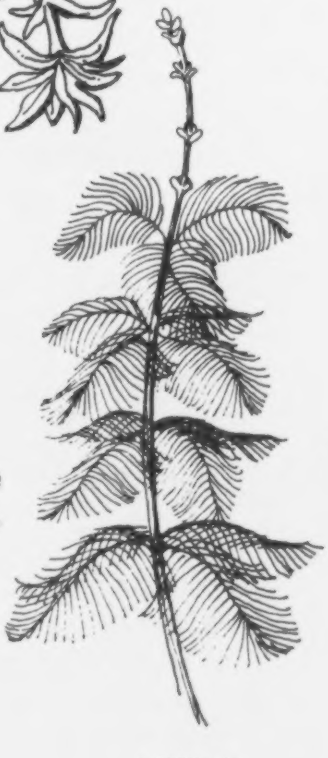
Elodea

Hornwort

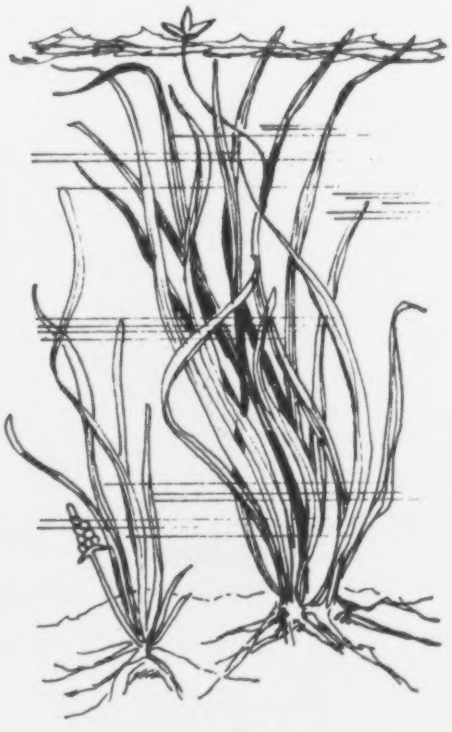
Hornwort belongs to the same family of plants as bladderwort.







Milfoil



Eel Grass

THE MYSTERY OF GREEN

Have you ever wondered why plants turn green in spring? Are all plants green? Think of some that are not and note below:

1.

2.

3.

When we think of plants, we tend to think of green, or those which contain chlorophyll and can produce their own food by a process called photosynthesis.

Photosynthesis simply means that the chlorophyll in the plant combines with sunlight and uses carbon dioxide and water to produce sugar for its food, and oxygen which is given off in the air.

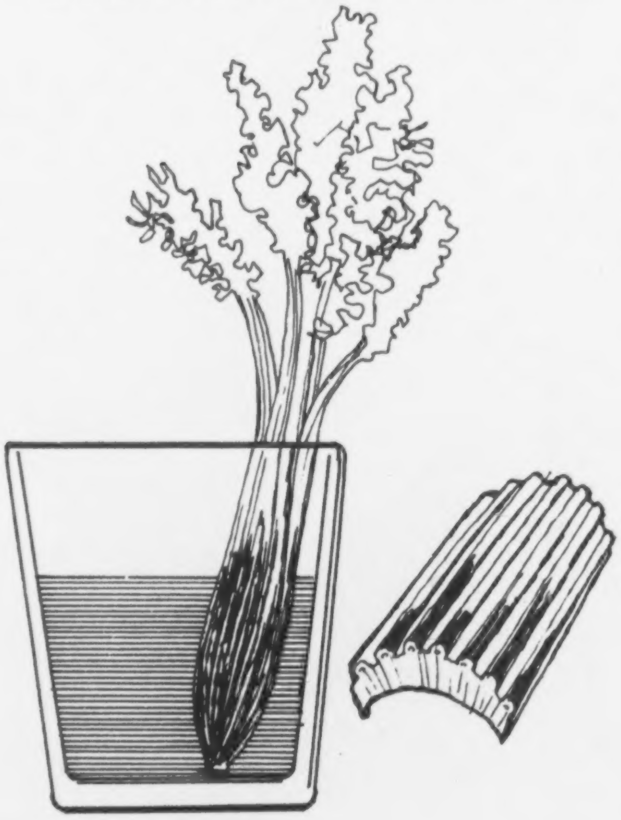
PHOTOSYNTHESIS

The word photosynthesis can be broken down into 'synthesis' meaning putting together and 'photo' meaning with light. Green parts of a plant, then are the food makers. The stem serves as a canal for carrying the food which is produced.

FOLLOW-UP ACTIVITIES

Next time you have a piece of fresh celery with plenty of leaves attached, fill a tall tumbler half full of water and add red vegetable dye (food colouring), then put the celery in it. Set the glass in a sunny window.

With the aid of a magnifying glass, you'll be able to watch the colour climb even to the leaves and see the network of veins in the stalk.



Some plants that aren't green don't produce their own food but get it from other living things or from dead organic materials. For example: where do mushrooms or other fungus plants live and get their food?

Most animals rely on green plants for survival. Why is the oxygen produced by photosynthesis important to us?

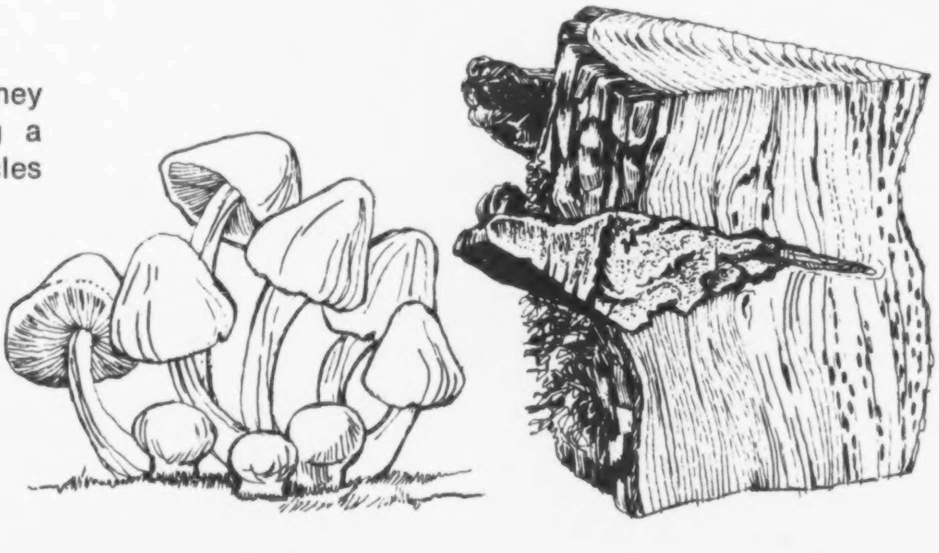
How are green plants essential in other ways?

SEED OR SPORE

Trees are primarily seed plants. A seed contains a baby plant and the food it needs for its early growth. Seeds are produced in the central part of the flower. All *seed* plants have flowers, *but* not *all* plants have flowers.

Spore Plants

Spore plants have no flowers. They multiply themselves by shedding a fine powder made up of tiny particles called spores.

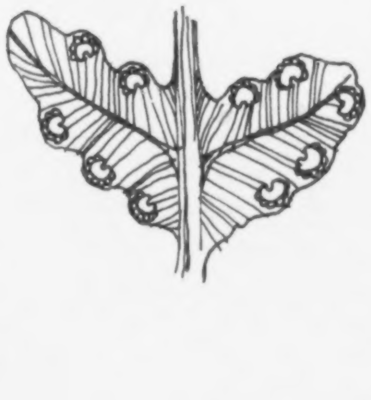


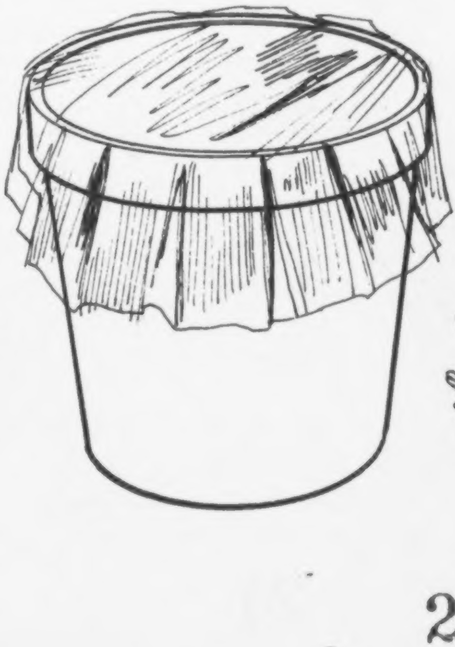
Try the following:

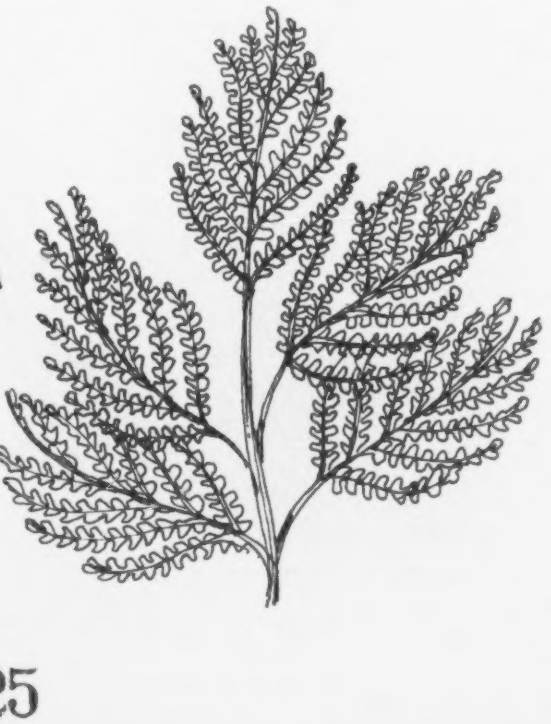
a. Place the head of a toadstool or mushroom upside down on a white sheet of paper and keep it in a dry place overnight. What you have made is called a spore print.

OR

b. Collect some spore clusters and put them in a flower pot with a few pebbles and some soil. Cover the pot with plastic or any clear wrap and keep it moist.







SPORES

A spore is a single cell, simple and primitive when compared with a seed. Each seed contains a baby plant and enough stored up food for the baby to live until it can produce its own. Spores are merely tiny sparks of life. They don't contain baby plants and they usually form plants different from the parent growth.

If spores hit moist ground they start as green threads of life which soon grow buds and produce tiny stalks and slender leaves. The male stalk produces sperm which swim in dew or melting frost to the female part of the plant. The female is the part in which the eggs are contained to be fertilized by the sperm. From this, develops the mature plant. You'll find spore clusters if you look for brown spots on the back of some fern fronds or a separate stalk entirely.

Other spore plants include

1. Algae, which grows floating freely in water.
2. Fungi, a group of plants including toadstools, mushrooms, moulds and tree brackets. Fungi are important to man not only because of their food value but also for their use in medicine. An ordinary bread mould provided the discovery of penicillin. Fungi also help (in the decay of dead plants and animals) to enrich the soil.
3. Lichens are a combination of two quite different plants. A fungus and an alga live together because the alga produces the food for itself and the fungus, and the fungus absorbs water to keep the alga from drying out. This *symbiotic* relationship allows the lichen to live on the bark of trees or on the ground or bare rock in exposed areas where neither plant could live alone.
4. Mosses are spore plants which live on the ground, on trees and on rocks in wet or dry places.
5. Ferns grow in dry fields, in moist woods or on rocky areas.

How do seed plants such as wildflowers, grasses and sedges spread their seeds and grow ?

Remember all plants which are not spore plants have flowers.

What does the flower of grass look like?

What are some other seed plants that you can find?

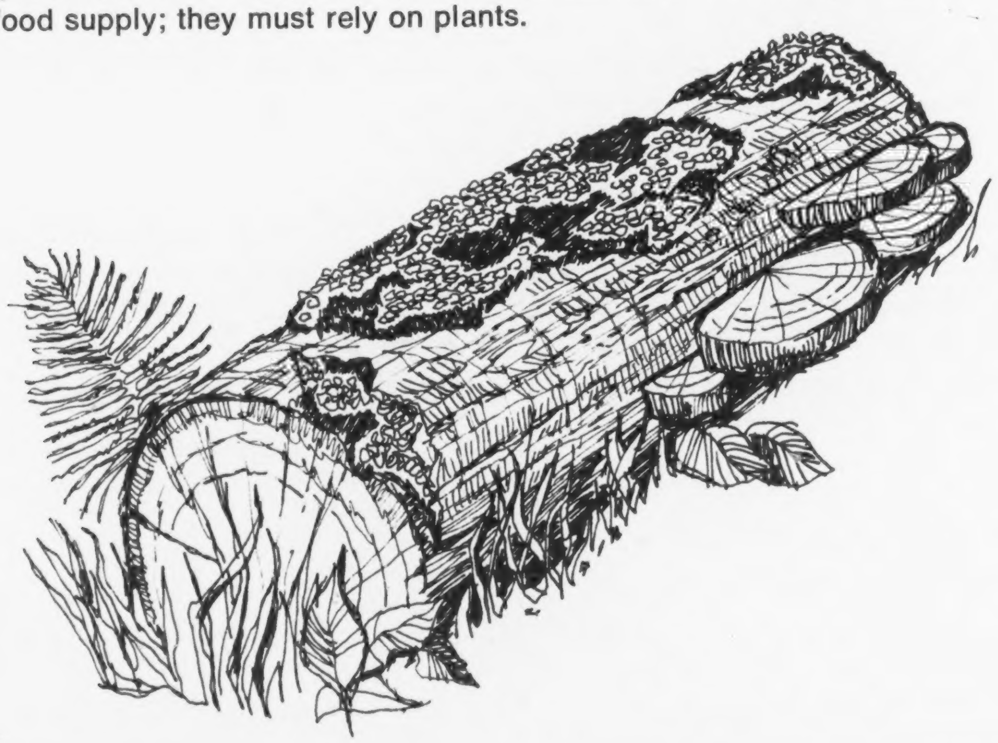
1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

In most cases, it is difficult to study just the plant part of life when animals and plants work so closely together solving the same problems. Looking at a tree, for example, you can see the food supply and habitat of many other plants and animals. However, animals cannot produce their own food supply; they must rely on plants.



Take, for example, this old and fallen tree. Not too long ago it was a growing plant. Now, it's all soft and crumbly. Mosses of different kinds are growing on it and their roots are spreading; breaking it up. Fungi and moulds are growing as well. Several saplings have rooted and will break it up further. Many animals are helping. Wood-boring insects and nests of ants are digging in the log. Birds have been chipping at it trying to reach the insects for food and larger animals are waiting to prey on the birds. As the log crumbles, particles of it are falling to enrich the soil which is growing thicker now and will support new, young plant life; which will in turn help to support animal life.

This is the circle of living things, a food chain. "The hawk that ate the woodpecker that ate the insect that feeds on the green leaf that grew in the soil."

Make a food chain of your own eating habits.

NAMING ANIMALS

Because of these eating habits and animals adaptations to their food supplies, we have devised a method of studying animals by the food they eat.

If a carnivore eats meat, what animals could you call carniverous?

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

How are these animals adapted to their eating habits?

If a herbivore eats plants, what animals could you call herbivorous?

1.
2.
3.

How are they equipped especially to eat their food?

What do you think an insectivore would eat?

Man, in his effort to study and understand other animals has divided them into two basic groups.

Invertebrates

These animals (worms, insects, crustaceans) have no backbone. Although they are similar in that they are invertebrate and have the same basic three problems of all living things, they cope with the environment in totally different ways. Each is a study in itself.

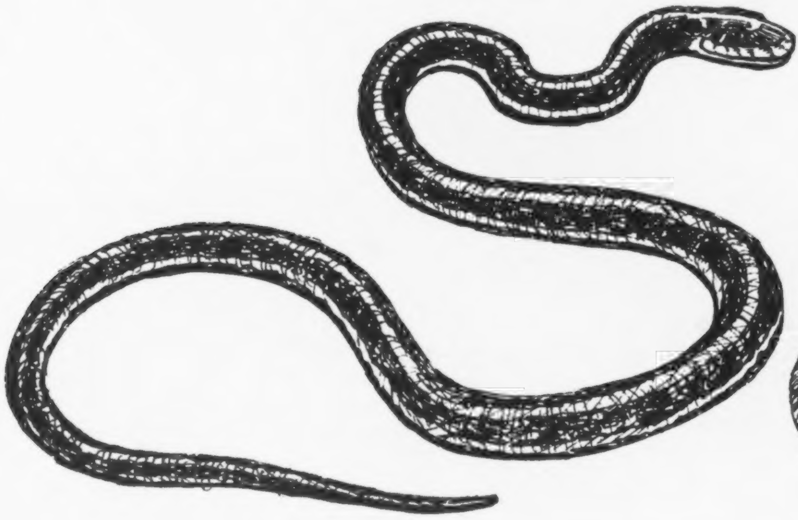
Vertebrates

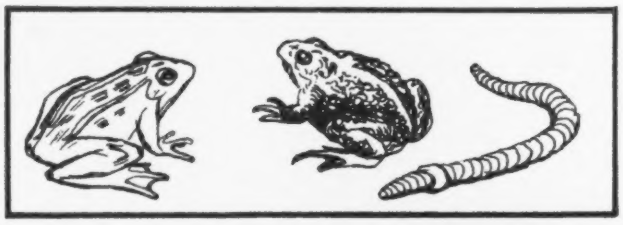
These animals (fish, birds, frogs, reptiles, mammals) have a back-bone. All of them are adapted to the environment in which they must survive.

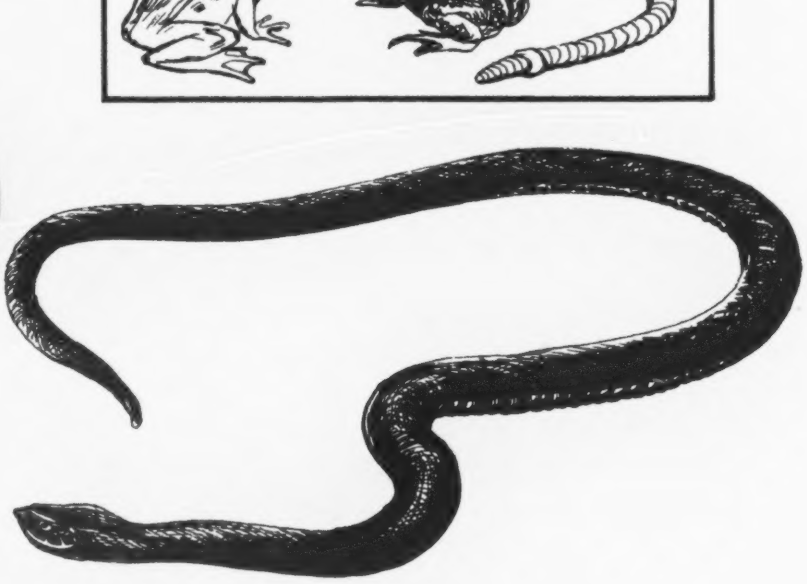
COLD AND WARM BLOODED ANIMALS

A bird or mammal stays at about the same temperature all the time. Its body is usually warmer than the air so we call it warm-blooded. A fish, frog or snake warms up or cools off according to the temperature of its surroundings. Its body is usually fairly cool so we call it cold-blooded. You can easily find an example of a cold-blooded animal to study if you go to the lighthouse on a cool day. There you will see that the flies are all sluggish and slow. On a warm day, however, they will be much more active. Snakes follow the same pattern of behaviour.

How could a snake cool itself on a very warm day?







MAMMALS

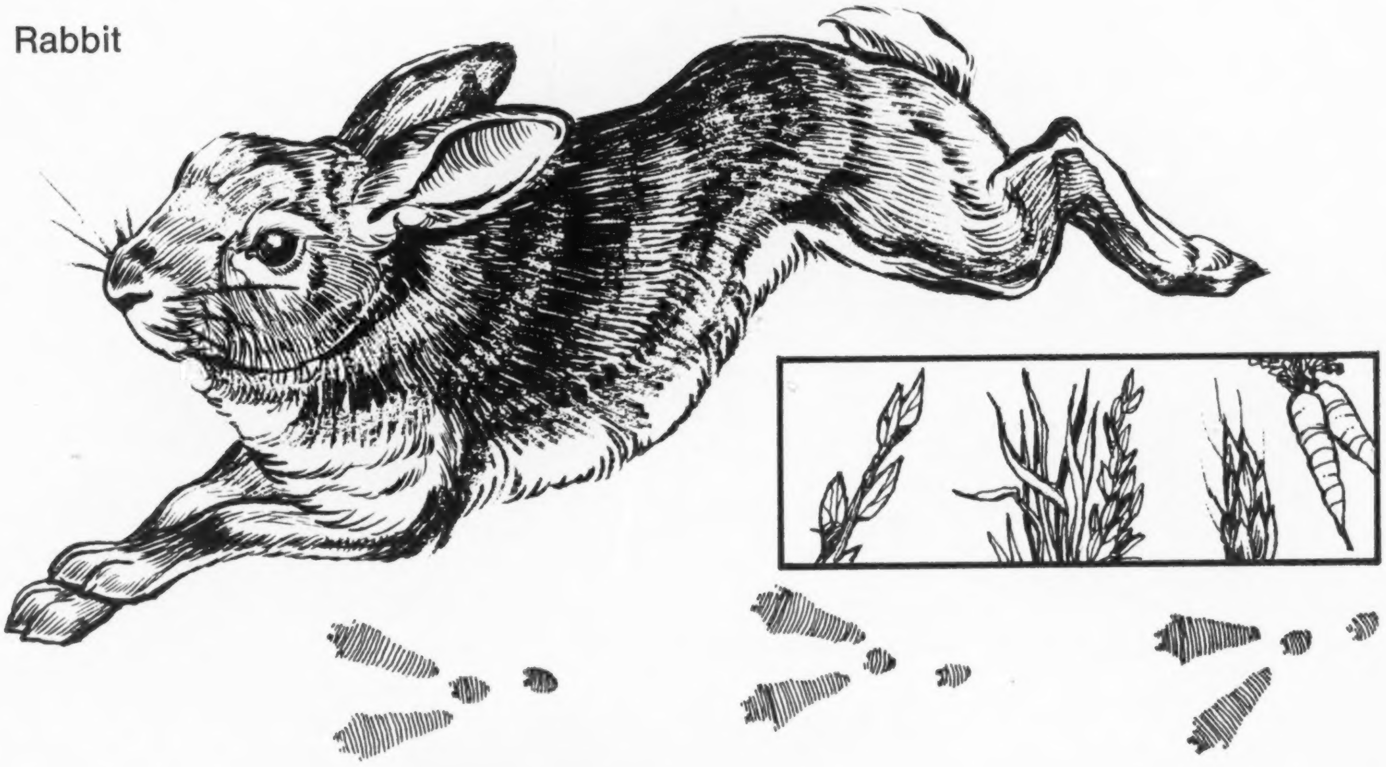
We define mammals as animals who have hair on their bodies, are warm-blooded and suckle their young of the mammary gland. By this definition, then, man is a mammal and by studying other mammals, man can learn more about himself. But animals are shy and try to avoid us generally. Most of them are nocturnal and only venture out after dark. We can follow them by tracking in the snow or mud. Watching the twigs and trees for signs of chewing, we can trail them to their homes and learn more about the foods they eat and the areas they are in most frequently.

"LIVE MAMMAL TRAPPING"

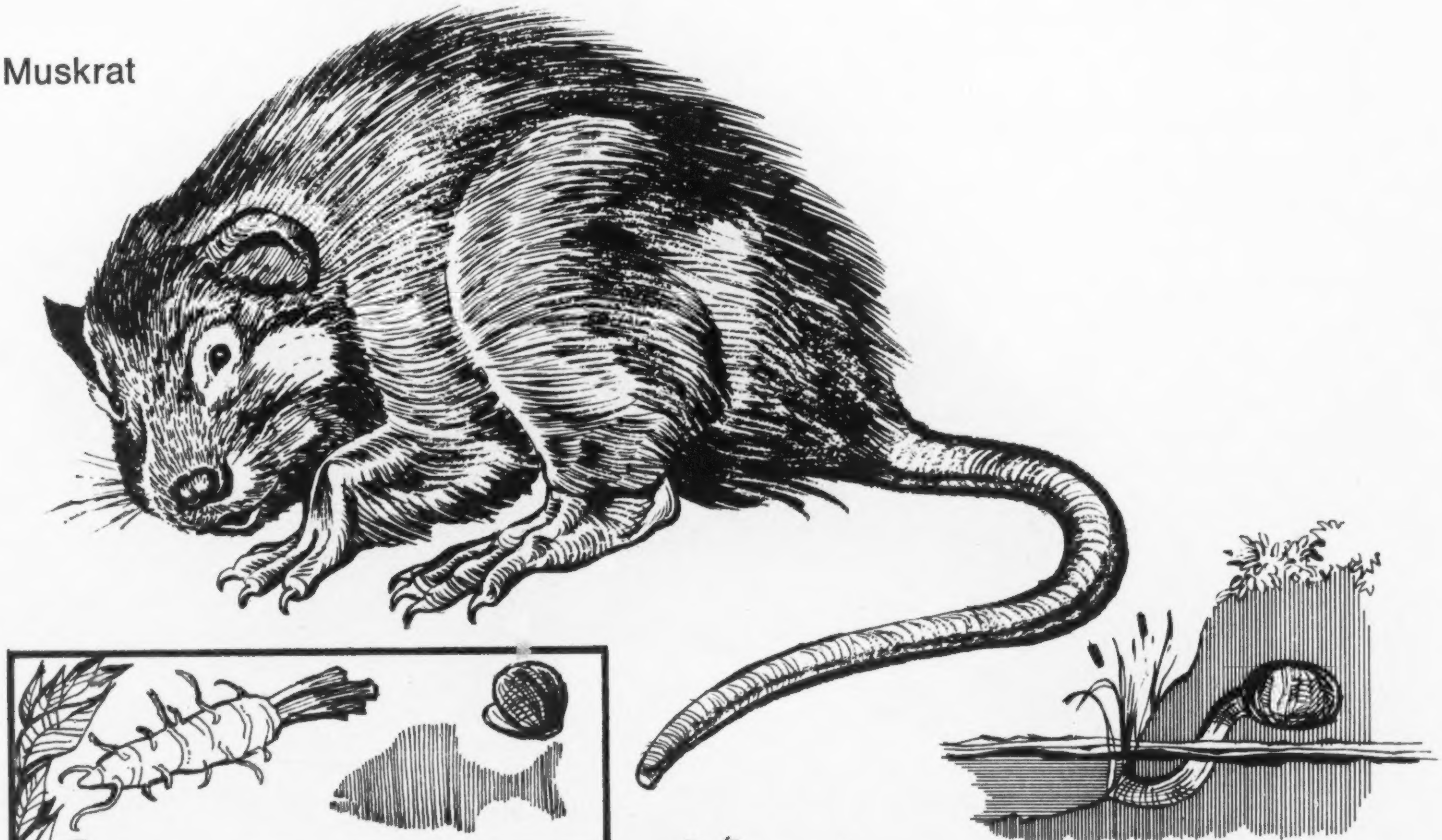
To study the basic needs and adaptation of animals to these needs, it is sometimes necessary to actually hold and see the mammal. In order to do this we use a trap which only holds the animal prisoner but doesn't kill it. The trap is baited and set in a position where the animal is known to run. After the information needed is recorded on a small card, the animal is released.

MAMMALS

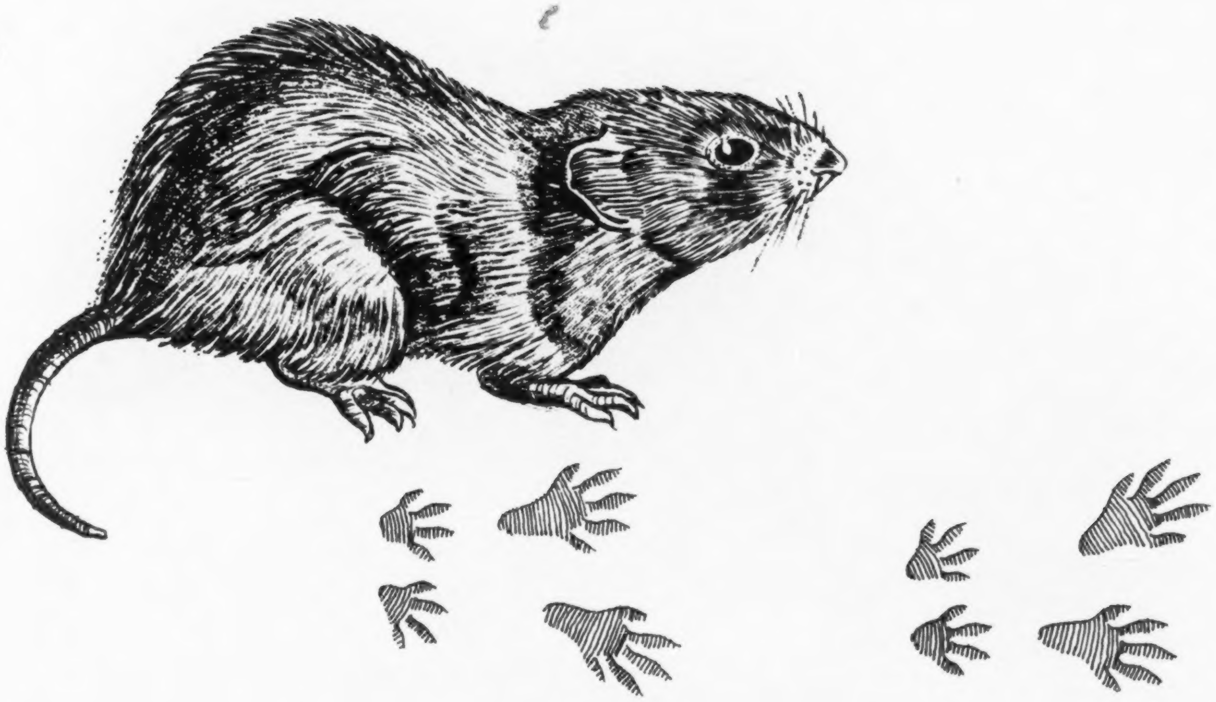
Rabbit

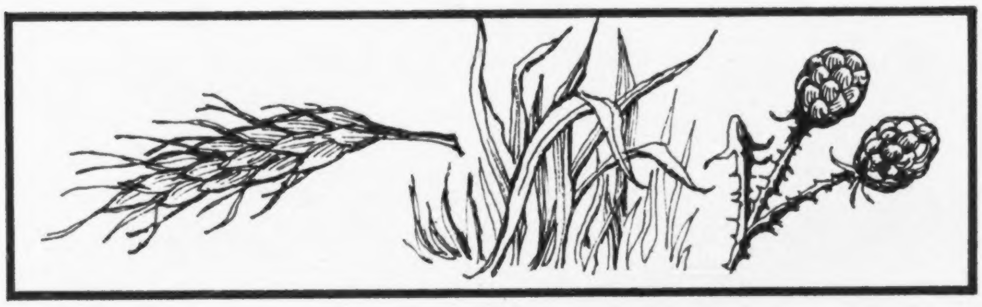


Muskrat

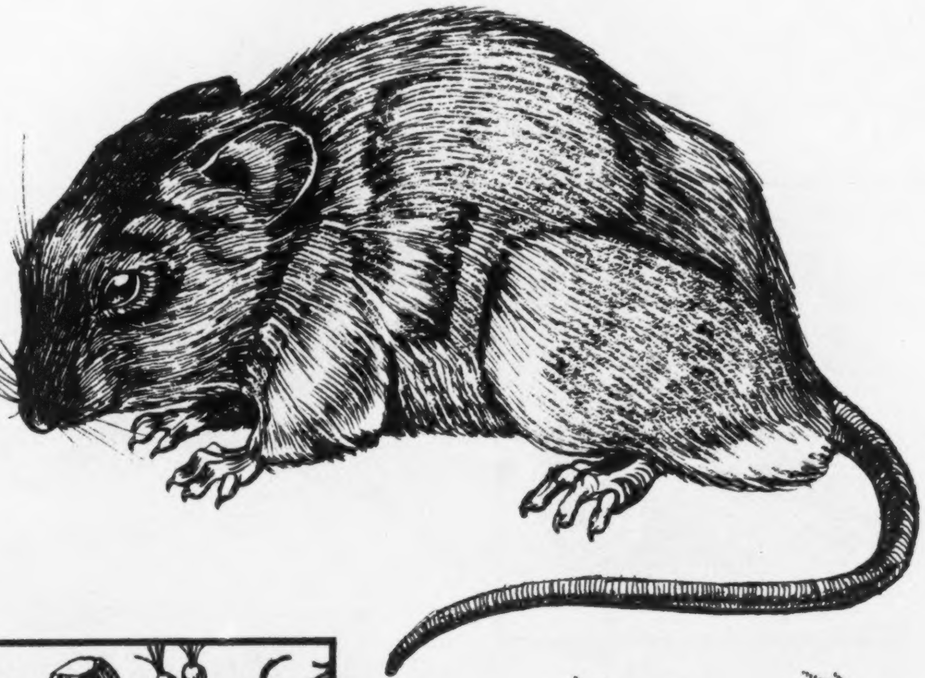


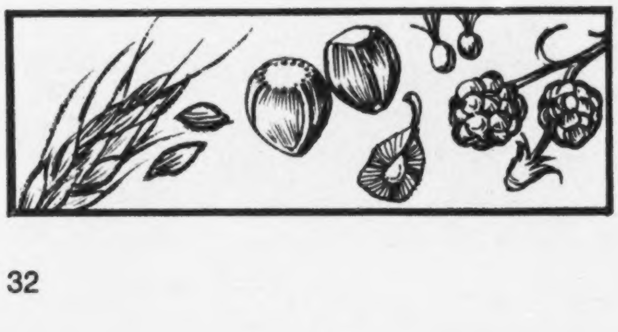
Vole

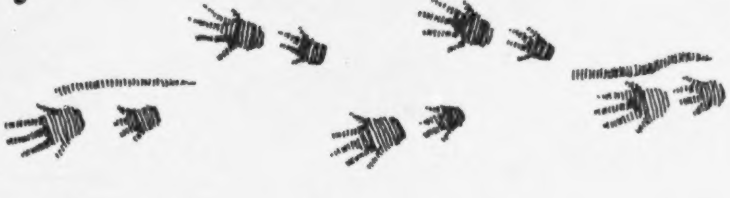


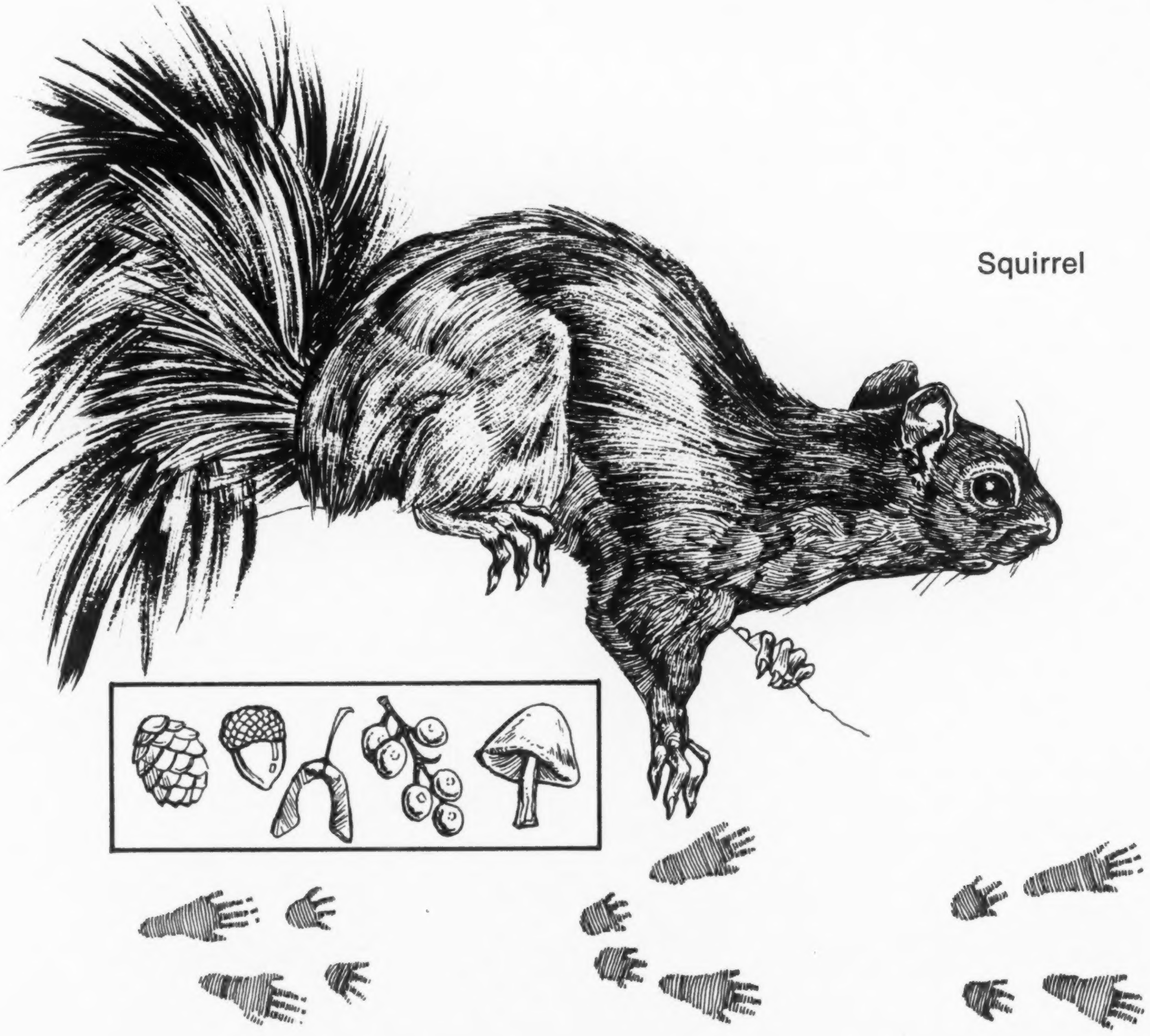


Field Mouse

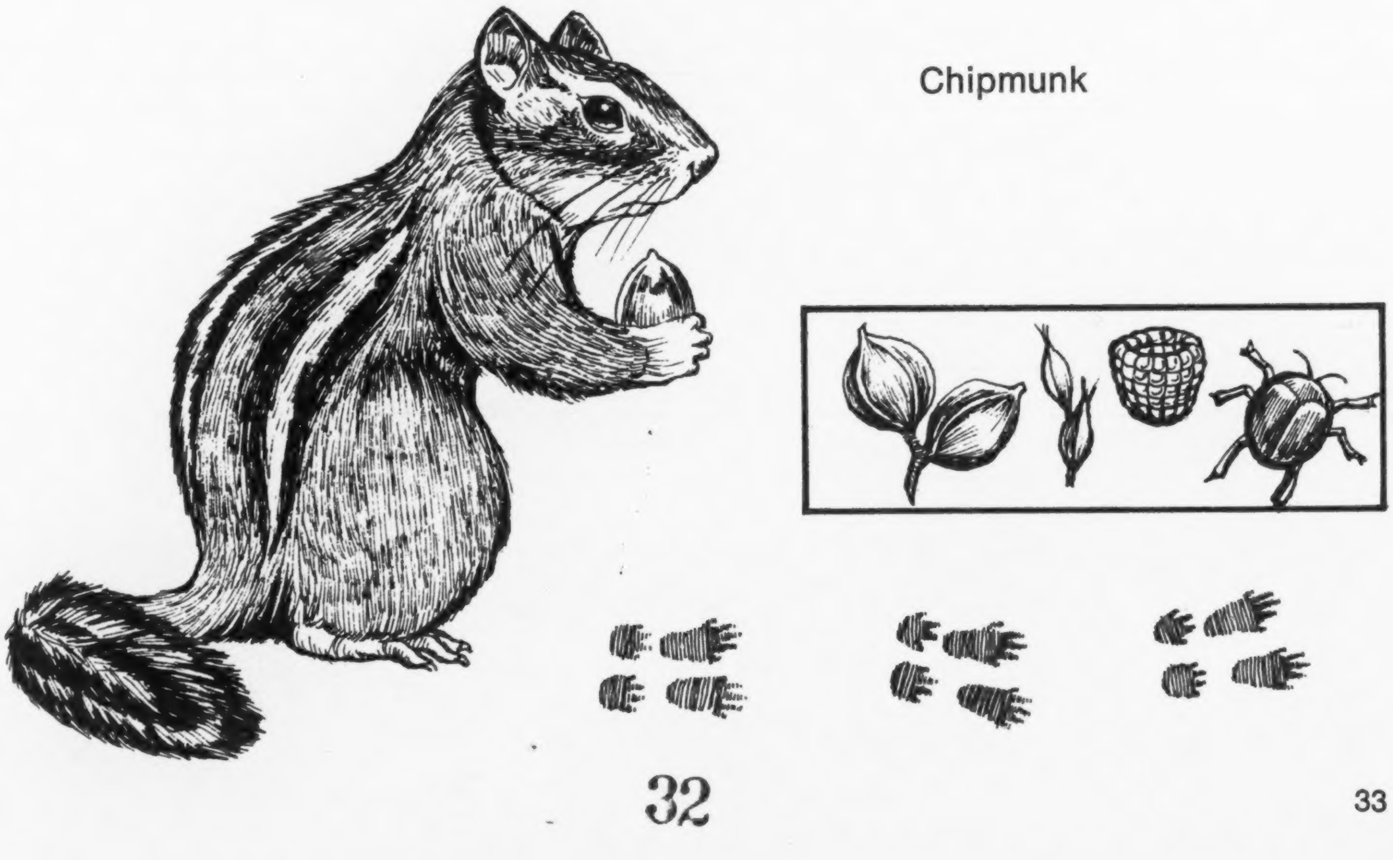








Squirrel



Chipmunk

NATURE TRAIL

One of the most interesting ways to study plants and animals is to set up a nature trail somewhere near you where you can set out every day to try to follow events. When you know what kinds of animals eat what types of foods, you can provide different types of feeding stations for the inhabitants of your trail and learn more about their habits.

Tracks made by animals can tell you where an animal has been and sometimes who it has met and, perhaps, what happened. Along the tracks you'll see signs of the animals' quick lunch at the nearest tree or perhaps droppings which you can take apart to find bits of the food that is now the waste material of the animal. Your nature trail will never remain the same. Every day it will change and wait for you to notice. Right in your own back yard.

POND ECOLOGY

POND ECOLOGY

What Is Ecology?

The earth has many different kinds of homes for living things: the seas, lakes, ponds, and streams; the deserts, forests, and fields. Each home or environment seems just right for the plants and animals living there. The place is right and so are the neighbours; various inhabitants provide food, shelter and other things for one another. All are connected together by their needs in one great web of life.

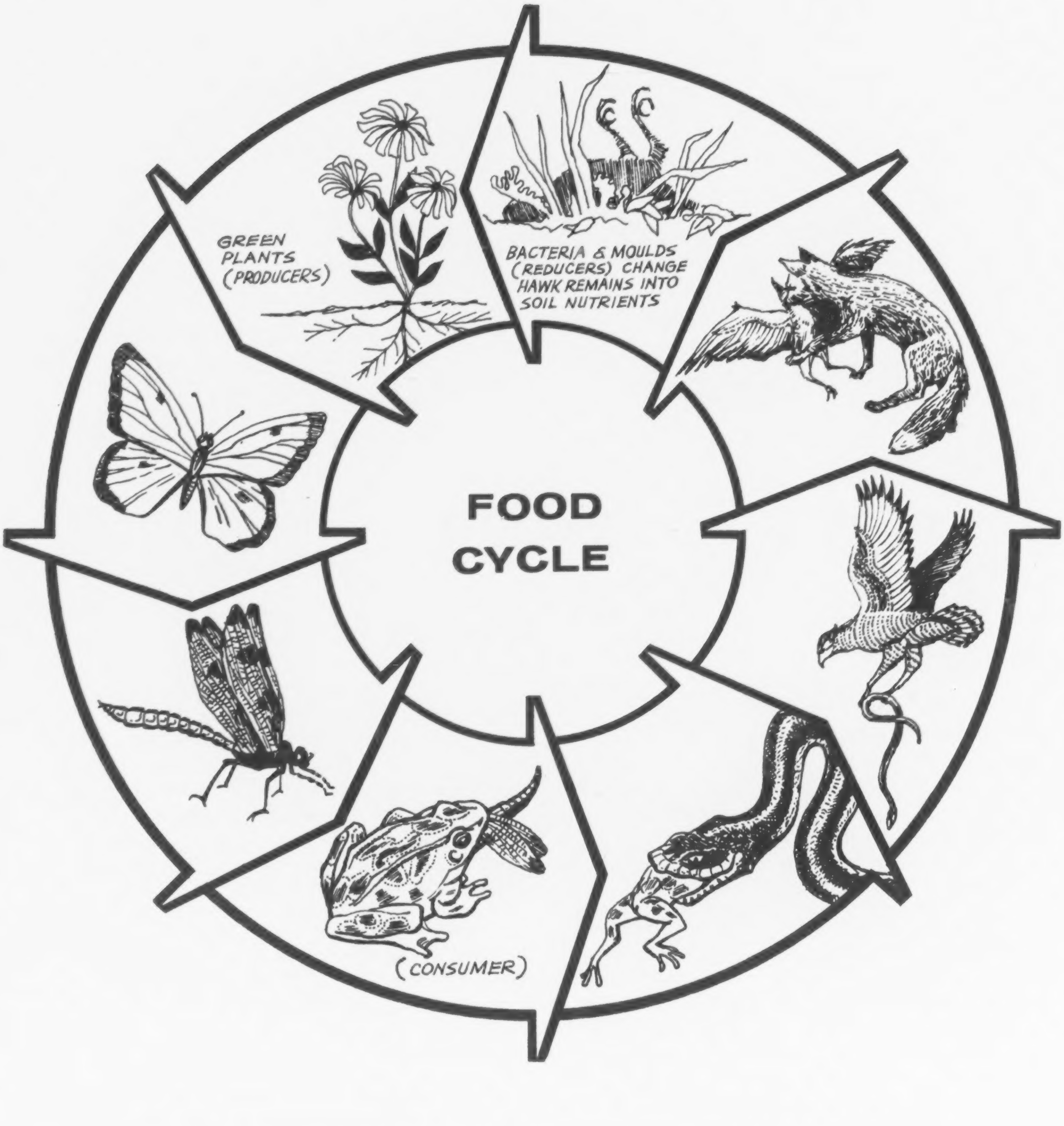
The study of these connecting relationships between plants and animals is called "ecology". It is a relatively new subject and one of increasing importance to man. Ecology is usually defined as the study of the relationships of plants and animals to each other, and to their environment. Man is becoming more aware of the many problems that may destroy his environment and is looking for solutions to them.

Why Do We Study the Pond?

Small changes in surroundings can have quite an effect on living things. One of the best illustrations of how plants and animals are suited to their environment is found in a pond. The pond can be compared to a closed room where most of the inhabitants must live for their entire lives. As a result, it is an excellent place to study the relationships between plants, animals and their environment.

Except for sunlight, the source of energy needed by green plants to produce food, a pond either contains or produces everything necessary for the plants and animals that live in it. One way of observing this process is through the supply of food in a pond.

All green plants, from the smallest plankton to the largest pond weeds, manufacture food. Plants become food for plant-eating animals, (herbivores) such as mayfly nymphs, small crustaceans and tadpoles. These animals are in turn preyed upon by the small flesh-eating animals (carnivores), including fishes, dragonfly nymphs and beetle larvae. Larger fish eat the smaller fish, crustaceans and insects. If not eaten, every plant and animal eventually dies and rots away to become the basic material that green plants need for growth. In this way the cycle of foods continues.


GREEN PLANTS (PRODUCERS)
BACTERIA & MOULDS (REDUCERS) CHANGE HAWK REMAINS INTO SOIL NUTRIENTS
FOOD CYCLE
(CONSUMER)

The above illustration of a food chain shows the transfer of food energy from producer to consumer. It then continues on from one consumer to another until finally the reducers, the moulds and bacteria, change it to a form that can be used by the green plants again. When food chains are interwoven with other chains, they are called a food web. There are numerous webs involving a wide variety of plants and animals.

Our example of a food chain begins with green plants as producers of food. Follow this simplified food chain around to see the relationships between the plants and animals in it.

What other arrows could be drawn to show the relationships between the producers, consumers, and reducers of food?

Could other animals such as the housefly or man be placed in this food chain?

Could any animals be omitted from this food chain?

Could you make a food chain showing a fish, algae, dragonfly nymph, and tadpole?

How Does Water Support Life?

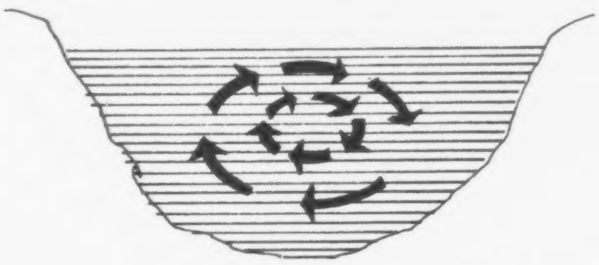
Water is all around us. It covers more than two-thirds of the earth's surface; oceans, streams, and lakes and little ponds are almost everywhere. Water has more properties which are beneficial to living things than has any other substance. It is 770 times heavier than air with a surface film upon which springtails can jump and water striders can walk. Snails and flatworms glide over its underside, while the larvae of mosquitoes thrust their air tubes through surface film and rest there, tails up and heads down. The greater density or thickness of water gives it more supporting power than air, so much so that fairy shrimp and a host of other animals can float motionless in it. It is a good transporting agent, too; even clear water carries a load of minute organisms upon which many still pond animals depend for food.

Only green plants can make their own food. In sunlight they combine water, minerals, and carbon dioxide to make sugars, starches and other foods. In return the plants release oxygen into the water. We can see this oxygen among the water plants on a sunny day as oxygen bubbles form and rise to the top. When pond weeds are disturbed, bubbles of oxygen which have been trapped often rise to the top. This oxygen is a gas that all animals must have.

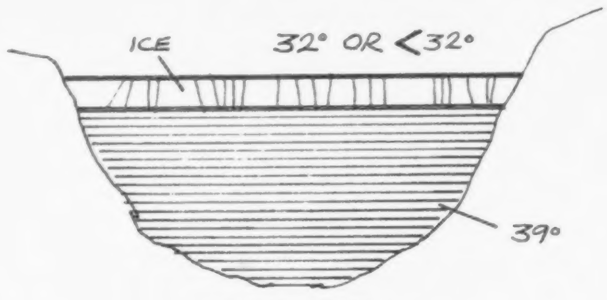
There are not only microscopic plants in the pond, but microscopic animals of one or two cells as well. When we put them under a microscope we find that some move so quickly that it is hard to identify them; others are so clear that we can see through them. These tiny protozoan creatures swarm by the millions through the water, grazing like cows on the microscopic plants. They in turn are food for the larger animals, such as insects, crayfish, amphibians, mammals and birds.

How Does Water Provide a Suitable Environment?

Changes in the temperature of water are not as sudden as in the air above; the pond is, therefore, a safe place for many plants and animals to live. Generally, cold water tends to drop to the bottom and warm water rises to the top. During spring, summer and fall, winds help to mix the water and the temperature is equalized throughout the pond. Animal life is then widely distributed.



SPRING AND FALL

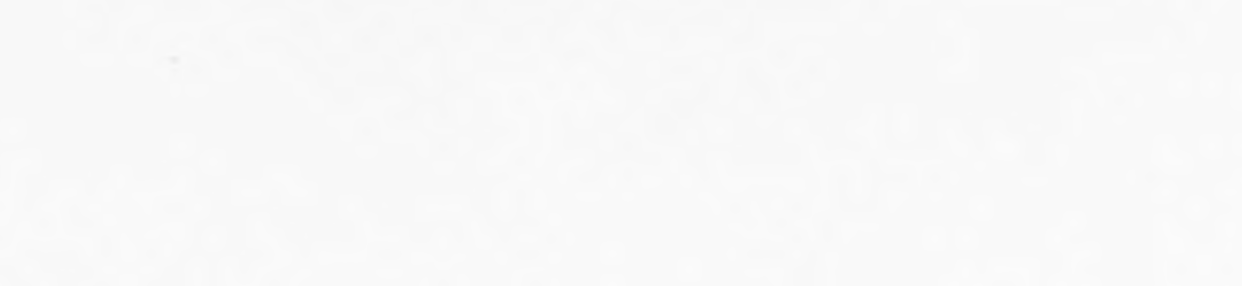


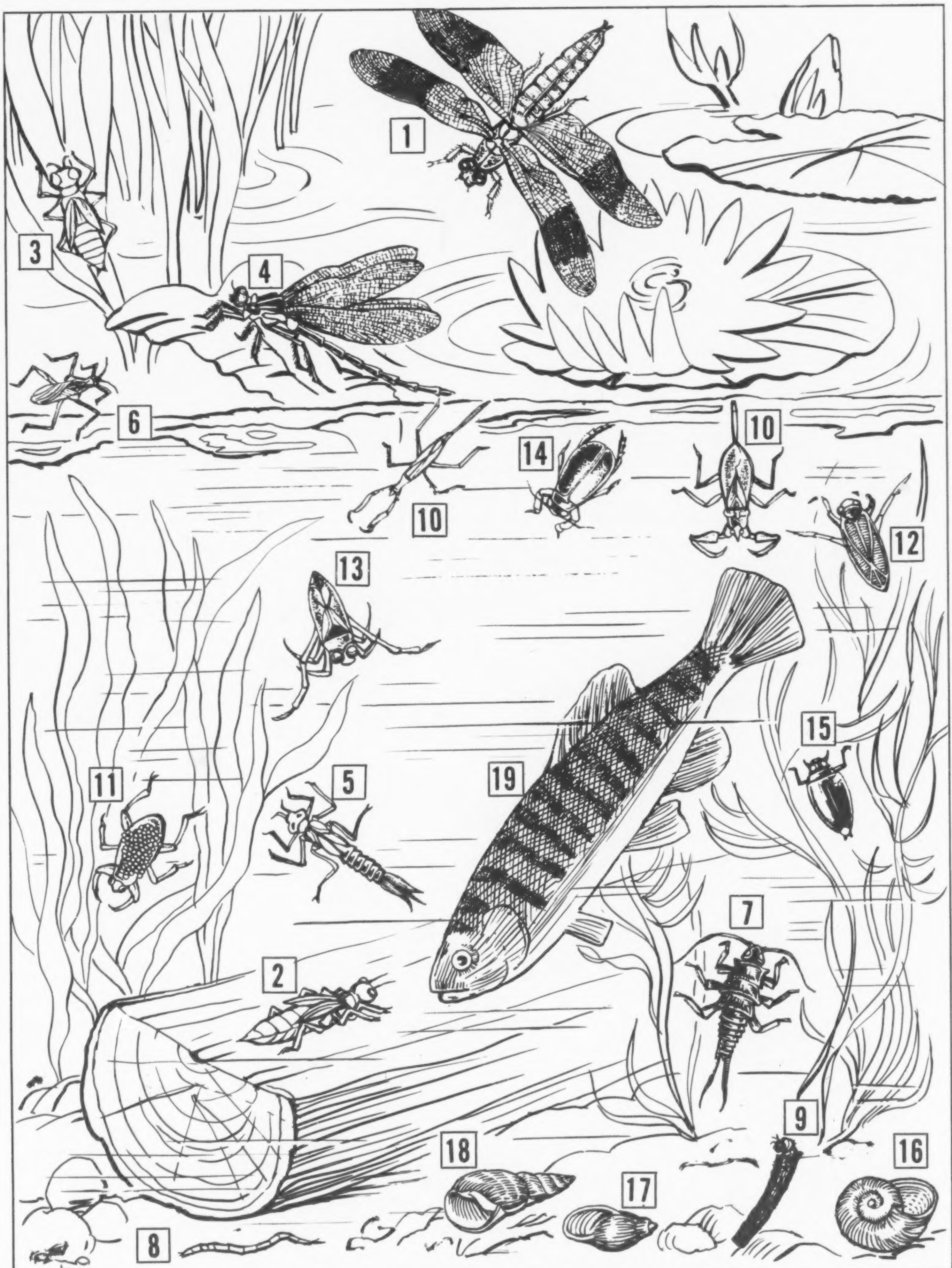
WINTER

Water is heaviest when it is cooled to a temperature of 39.2°F. at which it gradually forms a bottom layer. This movement of wind mixes the water and completely renews the supply of oxygen in it for the oncoming winter. As the surface becomes colder than 39.2°F., in the late fall, it becomes less dense (lighter in weight) and stays near the top. At 32°F. it freezes, the ice floats, and the pond is covered with a blanket protecting it from even colder winter temperatures above.

This blanket of ice prevents the wind from mixing the water and "winter stagnation" takes place. An extra thick layer of ice and snow block out the sunlight which plants in the pond need to produce food (by photosynthesis). Plants and animals may die off during the winter because of lack of oxygen. This is known as "winterkill". In some springs we have removed as much as a bushel of dead fish from the pond as a result of winterkill.

What will you find in the pond?




1
3
4
6
10
14
10
12
13
15
11
5
19
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2
9
18
16
17
8

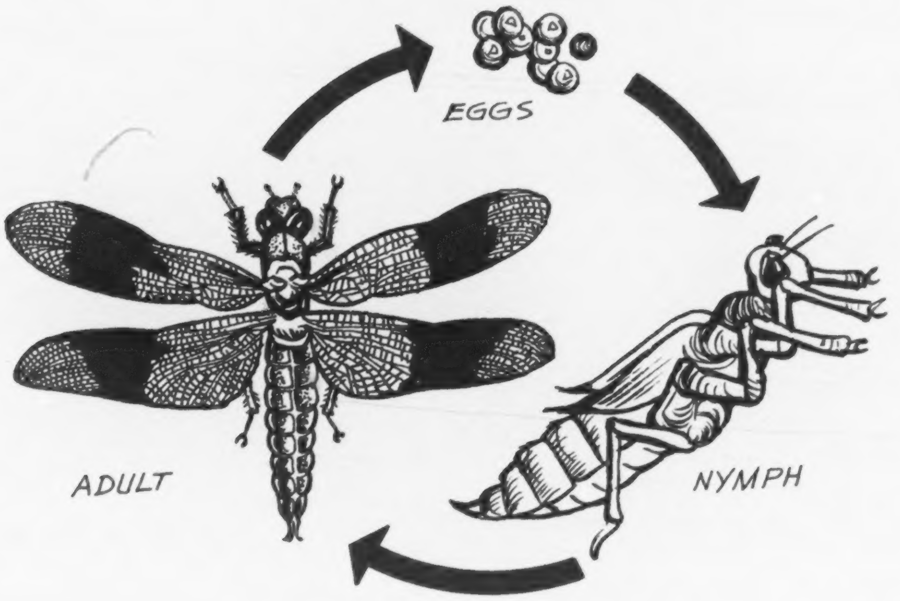
This illustration of the pond in summer shows some of the animals that you might find while visiting the island. You can use this list as a checklist of your finds. Names of other animals, as well as plants, may be added to this list.

✓

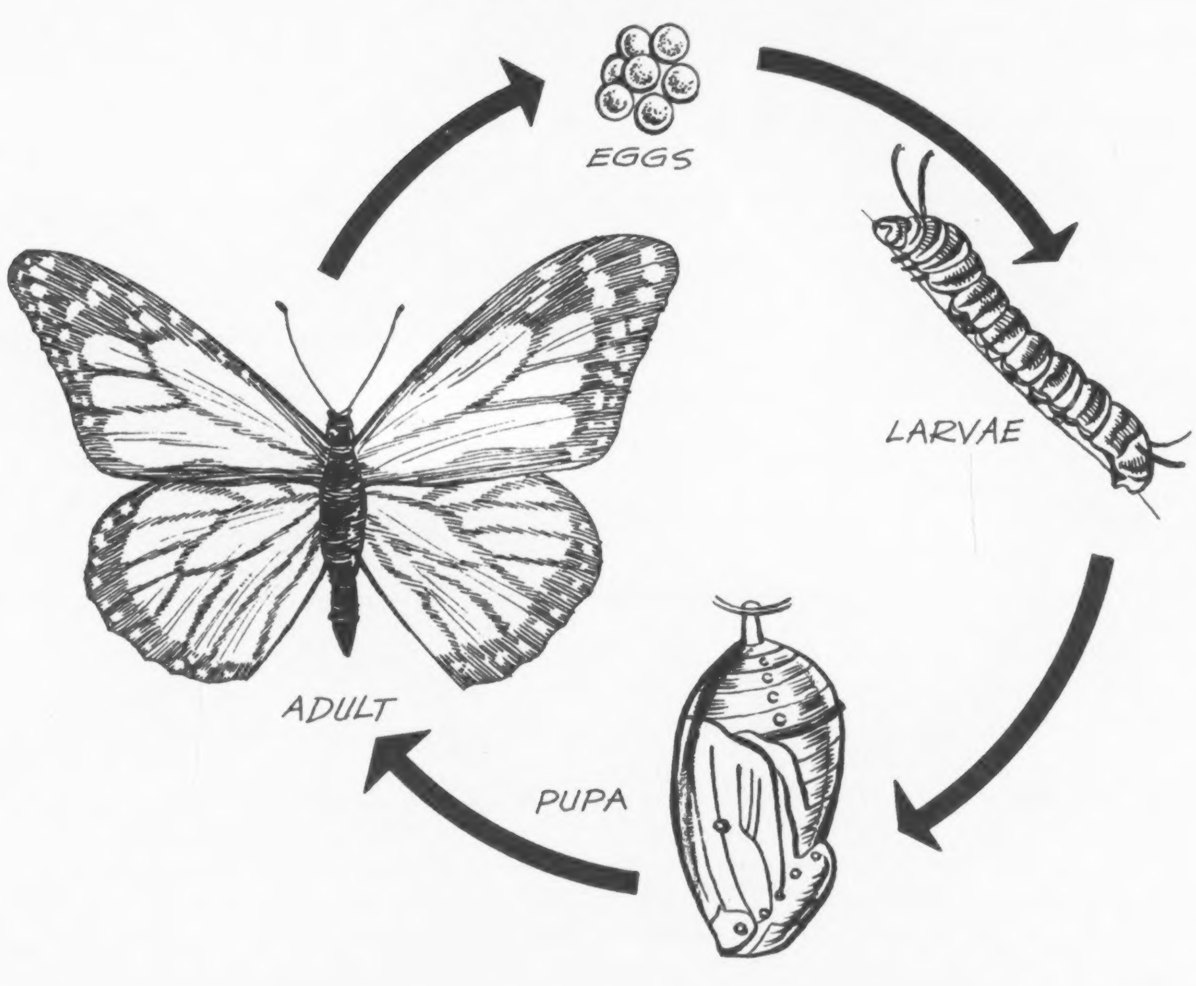
1. dragonfly ________ ☐
2. dragonfly nymph ________ ☐
3. cast skin of dragonfly nymph ________ ☐
4. damselfly ________ ☐
5. damselfly nymph ________ ☐
6. water strider ________ ☐
7. stonefly nymph ________ ☐
8. midge larva or bloodworm ________ ☐
9. caddis fly larva ________ ☐
10. water scorpions ________ ☐
11. water-bug (male with eggs on back) ________ ☐
12. water boatman ________ ☐
13. backswimmer ________ ☐
14. diving beetle ________ ☐
15. whirligig beetle ________ ☐
16. wheel snail ________ ☐
17. tadpole snail ________ ☐
18. pond snail ________ ☐
19. central mudminnow ________ ☐
20. ________ ☐
21. ________ ☐
22. ________ ☐
23. ________ ☐
24. ________ ☐
25. ________ ☐

LIFE CYCLE OF INSECTS

Incomplete Metamorphosis


EGGS
NYMPH
ADULT

Complete Metamorphosis


EGGS
LARVAE
PUPA
ADULT

Why are some insects called nymphs and others called larvae?

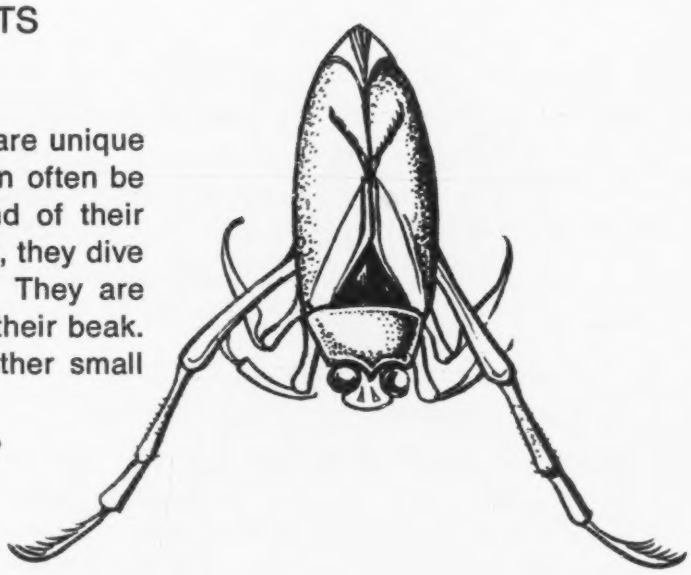
INSECTS

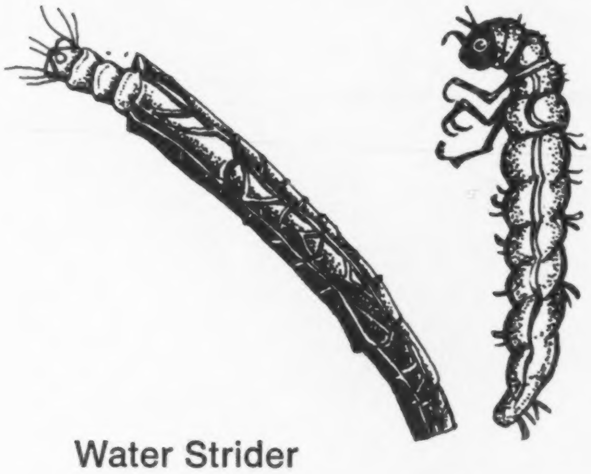
Backswimmer

These insects (with backs shaped like a boat) are unique in their ability to swim on their backs. They can often be found at the surface of the pond with the end of their bodies thrust up at the surface. When disturbed, they dive to the bottom carrying a silver bubble of air. They are quite active and can inflict a stinging bite with their beak. Backswimmers are predators which feed on other small insects.

How is the backswimmer adapted for swimming?

How is the backswimmer camouflaged?





Caddis Fly Larva

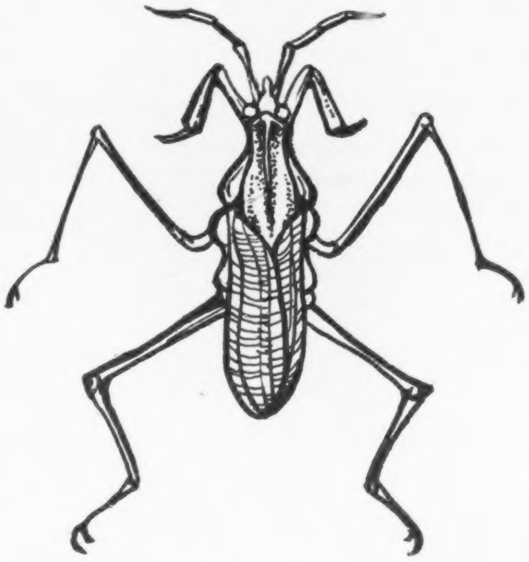
The larva stage of the caddis fly lives in a little case made of pebbles, or sticks, or leaves which it has cemented together with its own saliva. It has gills for breathing; therefore, it does not come to the surface very often.

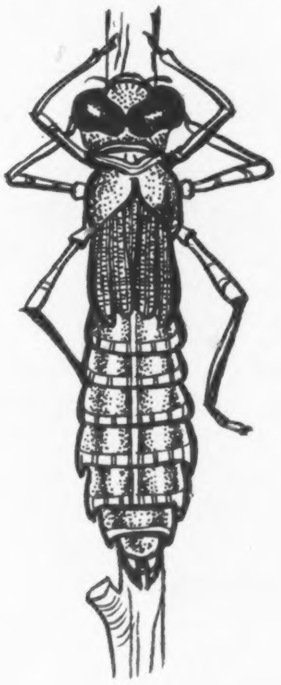
Of what value is the casing to the caddis fly larva?

Water Strider

Water striders or water skaters skim rapidly over the surface of the water on their long slender legs. They are predators feeding on backswimmers, emerging midges and insects that fall from leaves above the water. The adults pass the winter beneath protecting mud-banks, often clustered among pond weeds.

Water striders are often called spiders by mistake. How do they differ from spiders?





Dragonfly Nymph

Dragonfly nymphs are the dragons of the pond and prey on anything they can handle.

They take a long time to mature and usually spend the winter in the mud at the bottom of the pond. In the late spring, they crawl out of the pond and cling to a weed or other object above the water's surface. Their skin splits and the adult dragonfly emerges leaving behind the cast-off skin.

How is the dragonfly nymph adapted for catching its food?

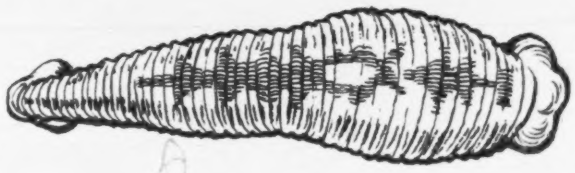
Observe a dragonfly nymph and note how it moves by "jet-propulsion".

LEECHES

Leeches are segmented worms similar to common earthworms. They have strong muscular suckers at each end of their body. Although most leeches are not thorough-going blood-suckers, they are all more of less bloodthirsty. They are sensitive to the slightest vibrations, to shadows passing overhead, and to slight chemical changes in the water. In these ways, they are attracted to food.

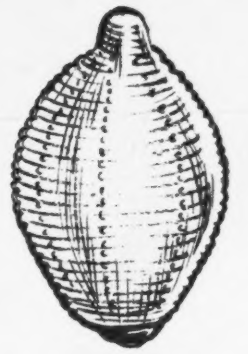
Turtle Leech

The turtle leech is broad and flat with a smooth surface. It is a greenish colour, striped and blotched with yellow. Turtle leeches are often found clinging to the skin at the base of the legs of painted and snapping turtles.



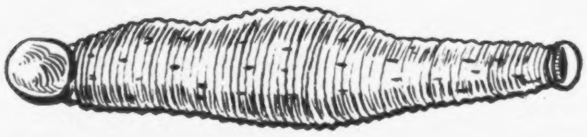
Brook Leech

The brook leech has a very flat body with a greenish back spotted with yellow. It feeds on snails and insects.

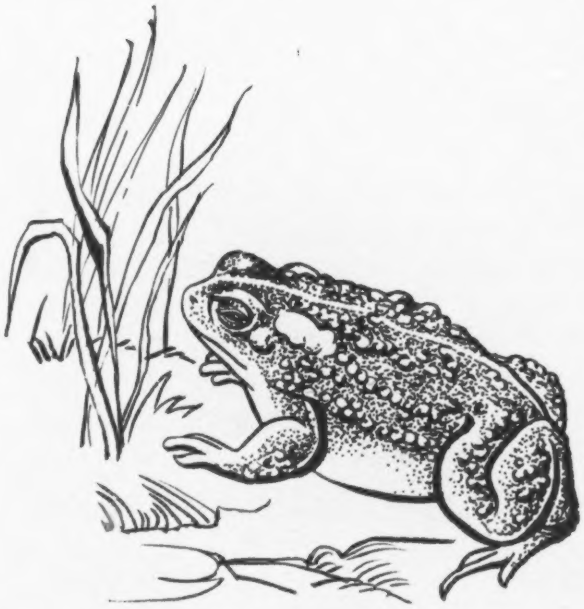


Horse Leech

The black horse leech, the largest leech found in the pond, is smooth and very soft. It feeds on aquatic worms and mollusks as well as the blood of any wading animals that it can cling to.



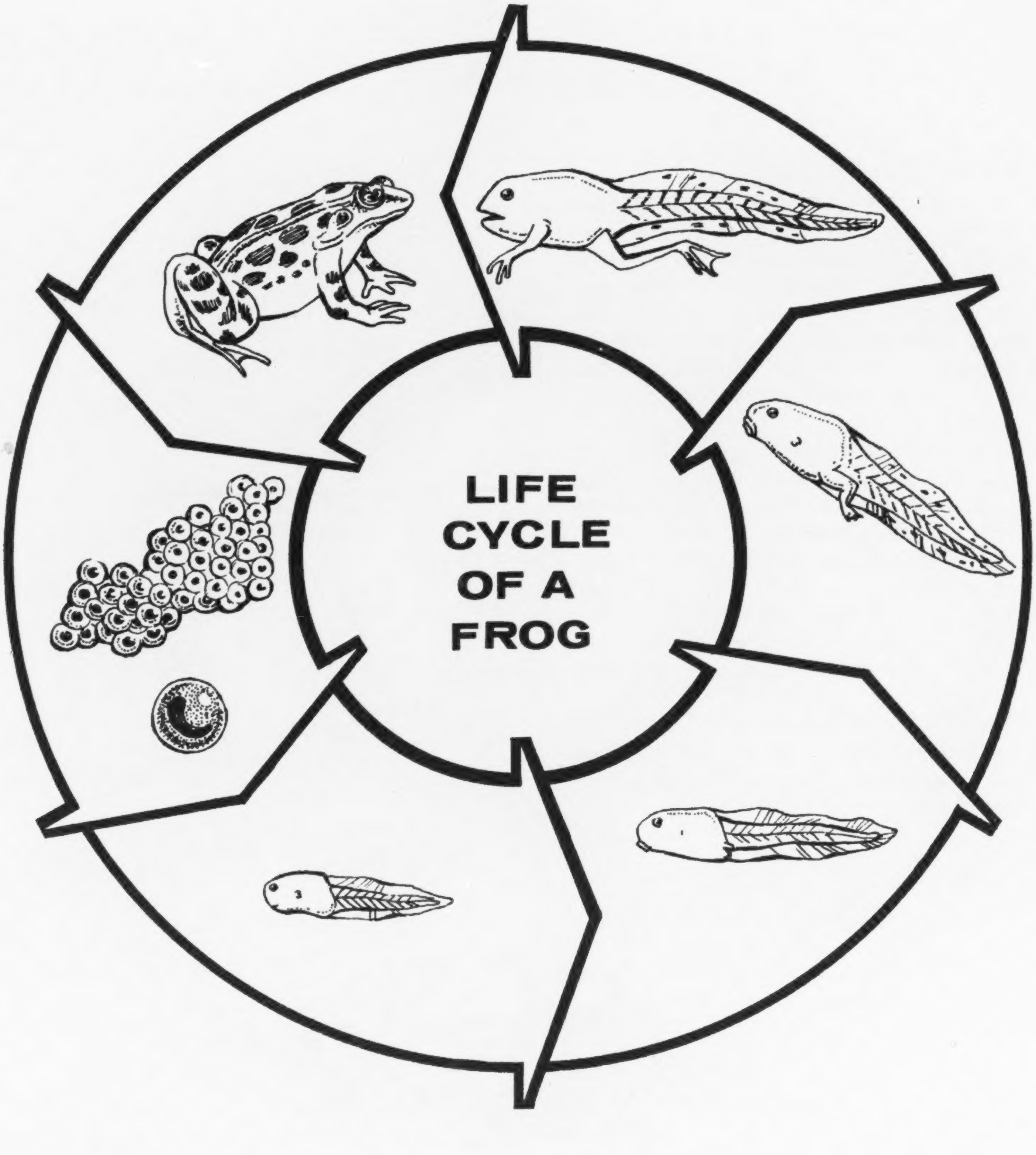
AMPHIBIANS

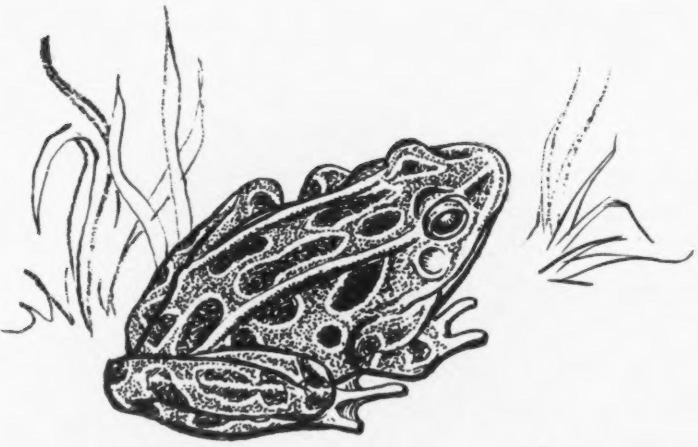


American Toad

The American Toad has a chunky, thick-set body with short legs. Its skin is brown, warty-looking and dry compared to the sliminess of a frog. The American Toad is the only toad found in this area. The male of the species is smaller than the female which can often be as big as a child's hand.

Toads lay their eggs in long strings during the month of May. One toad can lay from four to twelve thousand eggs. The eggs hatch into tadpoles within five to twelve days. From the middle of May until late in July, the pond swarms with tadpoles, transforming into toads. After laying their eggs the old toads leave the pond and scatter into the woods and fields.

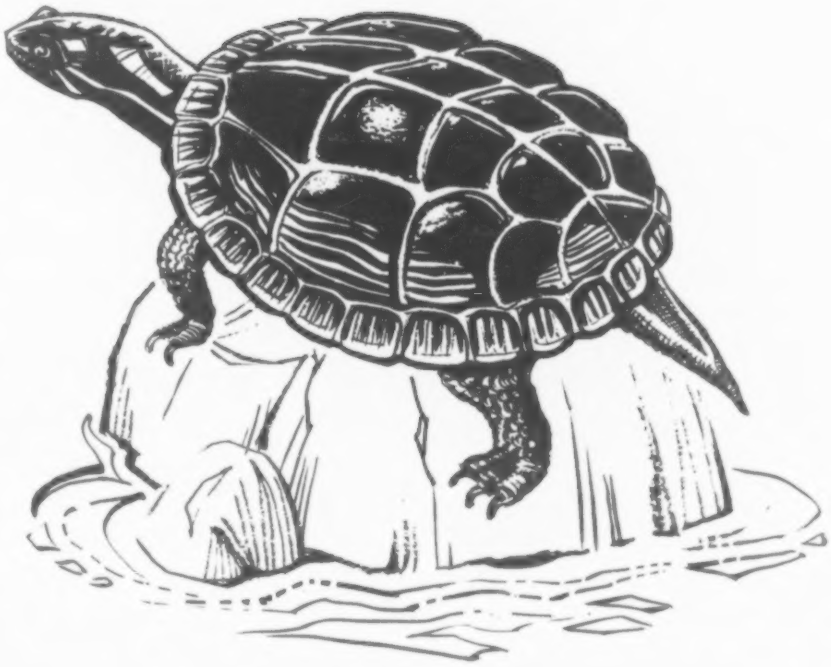




Leopard Frog

The leopard frog is green or olive green above and covered with dark spots rimmed in white or yellow. It is pure white underneath. The eggs are laid in early May in masses of about four to five hundred. By late July or August the tadpoles are transformed into young leopard frogs.

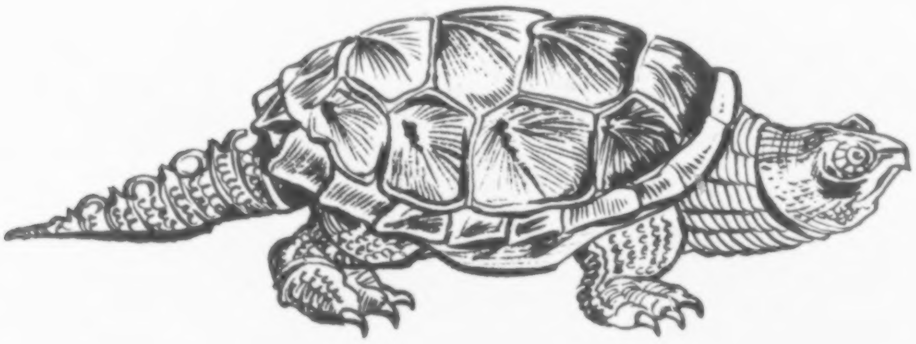
Midland Painted Turtle



You would almost think that this turtle has been handpainted with its small marginal plates of red, black and yellow, its two bright yellow markings behind each eye and the stripes of yellow and red on the throat, legs and tail. The bottom shell (or plastron) is light yellow. The length of the adult turtle's shell is about six to eight inches.

Painted turtles feed on almost anything that they can find under water, but they seem almost unable to swallow when out of water. If you approach the pond quietly on a sunny day, you might see them basking in the sun on logs in the water, but when alarmed, they slip quickly into the water. In October, they dig into the mud at the bottom of the pond for their winter hibernation.

Painted turtles bought in pet shops are not natives of this area but are from the southern states. They usually die if released here.



Snapping Turtle

The snapping turtle is one of the fiercest creatures in the pond. It has a large head set on a long neck that can reach out to catch its prey. The snapping turtle uses his toothless beak to catch and tear its prey such as small fish. The lower shell is small, allowing for free movement of the legs and long neck.

Snapping turtles commonly weigh from 25 to 30 pounds (sometimes 40 pounds) when full grown and are over two feet long.

FISH

Carp

This fish which originated in Asia was introduced into Ontario in the late 19th century. The carp is slightly flattened and averages from one to three pounds in weight; however, twenty pound fish are not uncommon. The body is covered with thick large scales. The mouth is medium sized, toothless, and has the upper jaw protruding. There are two pairs of feelers about the mouth, the pair at the corners of the mouth being the most obvious.

The carp's main foods are insects, snails, water plants and at times, domestic wastes that are on the bottom. This is one fish that does well in polluted waters.

Goldfish

The wild goldfish resembles the carp except that it does not have feelers about the mouth; it has a stockier body and is more varied in colour. The goldfish rarely reaches the size of the carp. Its basic body colour varies from olive-green through gold to creamy white with occasional blotches of black. In parts of Ontario, sizes up to two pounds can be found. Insects, snails, and aquatic plants are its main foods.

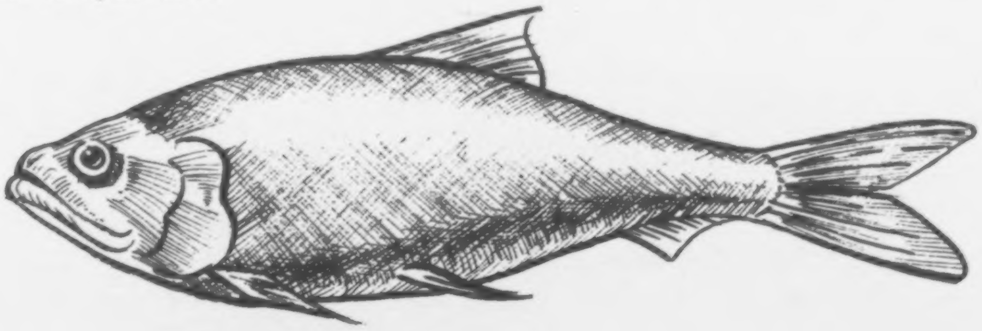
Central Mudminnow

The central mudminnow is small (seldom more than 3½ inches long) and has a small mouth and soft-rayed fins. Its body is brown or olive-brown with 13 or 14 irregular black bars on the sides and a black bar at the base of the tail fin.

The name mudminnow is derived from the fish's preference for muddy bottoms of ponds and sluggish streams in which it seeks shelter when alarmed. It feeds on plankton, aquatic insects and sometimes smaller fish.

Alewife

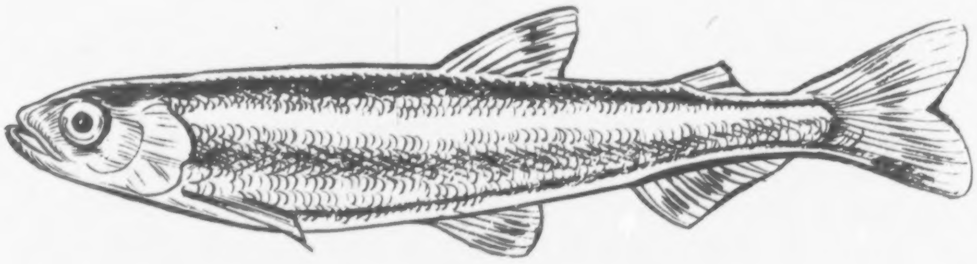
The alewife has a deep body which is quite flat. Its back is green or brownish-green (dark blue after death), shading to bright silvery on the sides and belly. A dark spot is often evident just behind the head. The average length of the Lake Ontario Alewife is 6 inches. During the summer months our beaches are covered with the dead and decaying bodies of alewives. Recent studies indicate that the "die-off" is related to changes in water temperature.



Smelt

The smelt has a slender, silvery body. It has strong teeth on the jaws and also on its tongue. The male can be identified by the roughness of its scales. The smelt is caught by fishermen in seines and various types of dip nets during its spring spawning runs. In the Great Lakes spawning takes place in the early spring, usually in April, depending on climatic conditions.

This species was introduced to the Great Lakes in the late 1800's. It multiplied rapidly and is now important as a food for both fish and man.



BIRDS

BIRDS

What is a bird?

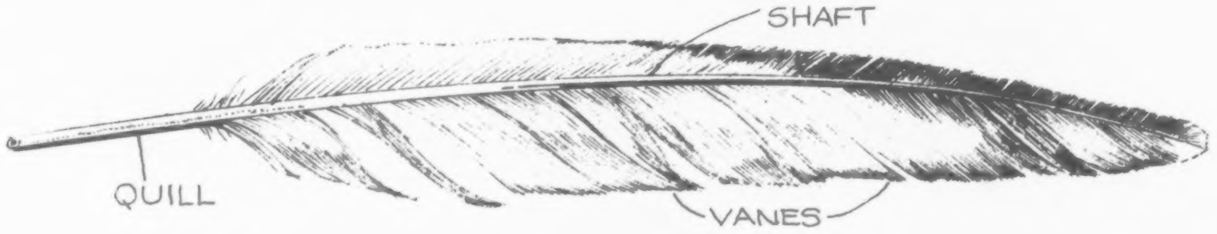
Is it a flying creature?

An animal that lays eggs?

Or a creature with a beak?

None of the foregoing makes a bird a bird. Insects fly, snakes lay eggs and the Duck-billed Platypus of Australia is a mammal with a beak. But none of these are birds.

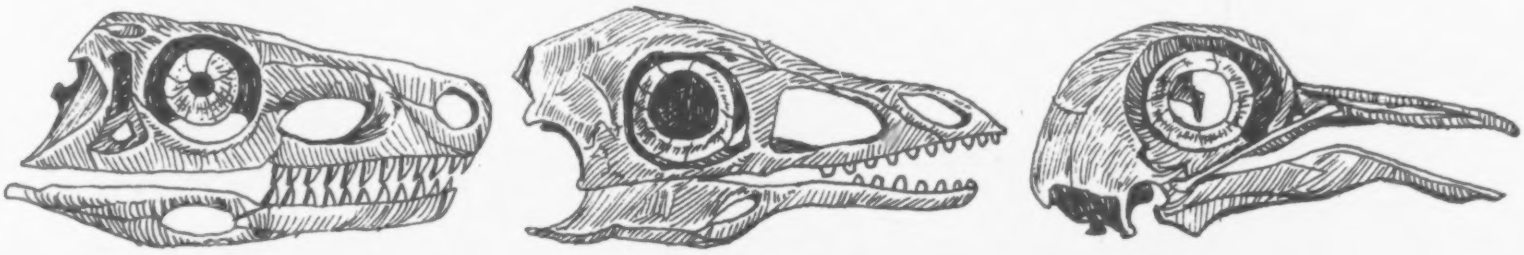
A bird is a creature that has feathers. Because of this unusual body cover most birds can fly, but not all of them. The ostrich and penguin are two of the best known non-flying birds, but both are feathered and thus are birds in the truest sense.



Where did birds come from?

Scientists believe that many millions of years ago birds were reptiles. The fossil bird, *Archeopteryx,* which is about 150 million years old, and the oldest known, is largely a reptile. It has teeth, a scaled, snake-like head, a long lizard-like tail and claws sticking out of its wings. But it is still a bird, it has feathers!

By looking at the pictures below you can see how changes took place in the skulls of living creatures over time to form the modern bird. This process of change is called evolution and is a process still at work today.



Birds of today have many reptilian characteristics. Some of the most obvious are the scales found on legs and feet, the primitive shape of the brain and the laying of eggs.

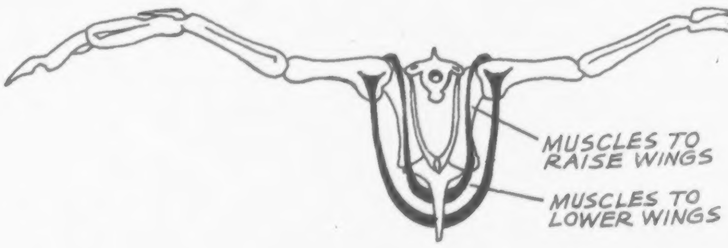
The next time you have a boiled egg, note the thin skin-like membrane. This is the same covering as is found on the eggs of snakes, turtles, and lizards. Some birds even continue the reptile's practice of burying their eggs in soil and allowing the earth's heat to hatch them.

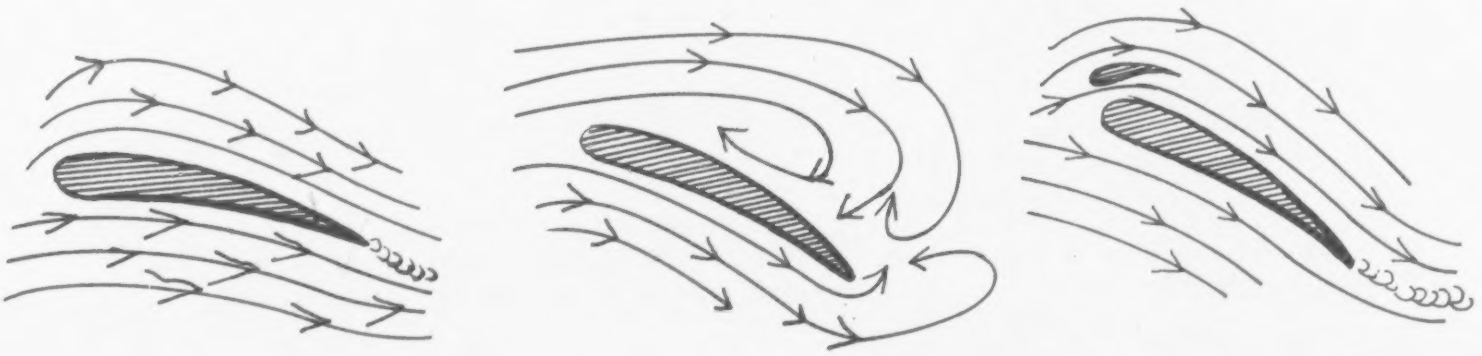
Why do birds look different?

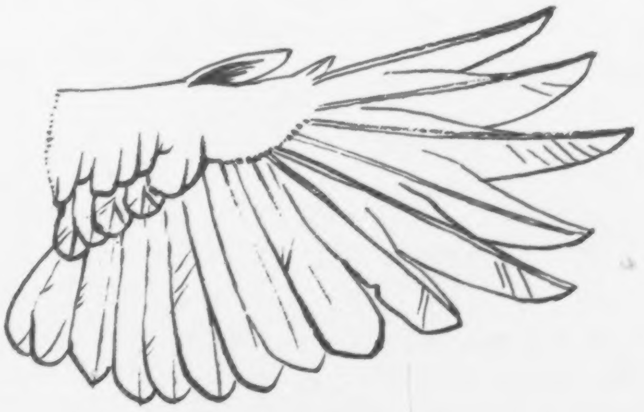
On the following pages are illustrations showing how birds are specially adapted to flight and procuring food. Adaptations are changes that take place in a living creature to help it survive successfully. Humans adapt daily to weather conditions. In winter we put on heavy clothing so that we will not freeze to death.

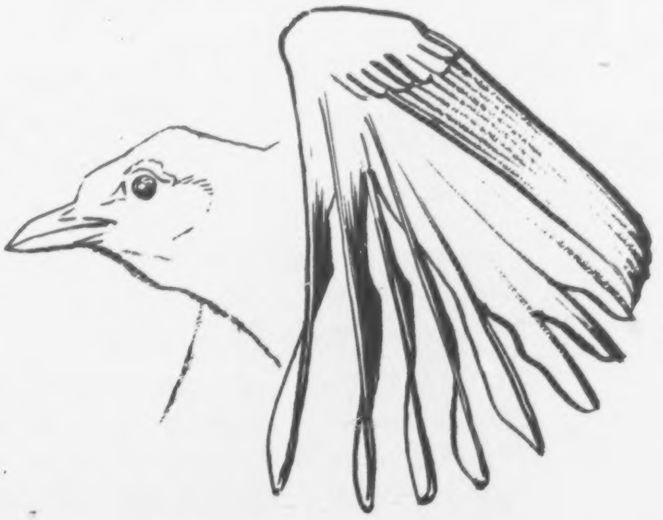
Birds are also adapted to climatic conditions. Migration is a seasonal adaptation; birds move north and south with the coming and going of summer. Birds that stay in certain climatic areas all year round are specially adapted for them. The Snowy Owl (Nyctea Scandiaca) who spends the whole year in the Arctic is well feathered from head to toe; even its nostrils are covered in feathers to preserve warmth. In contrast stands the Ostrich (Struthio Camelus) of Africa with naked head, neck and legs. The bird is kept cool by giving off extra heat through the naked patches.

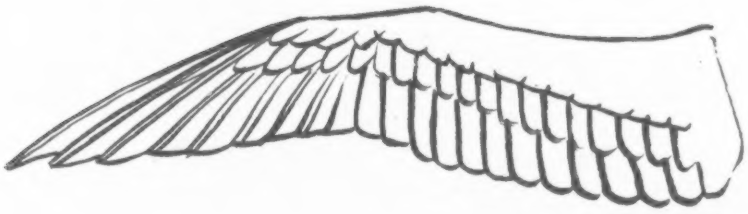
How birds fly

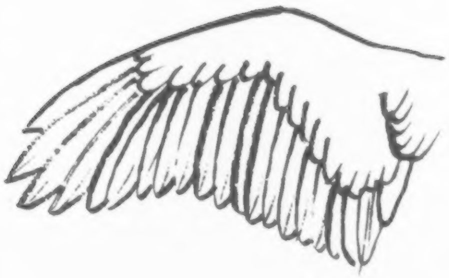


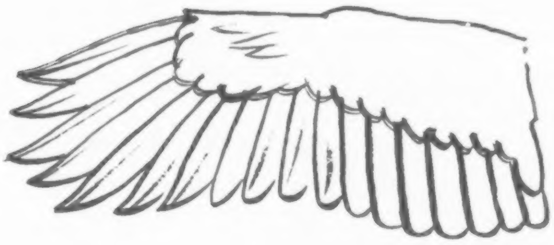


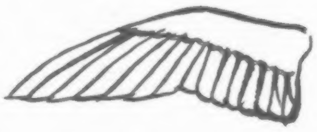




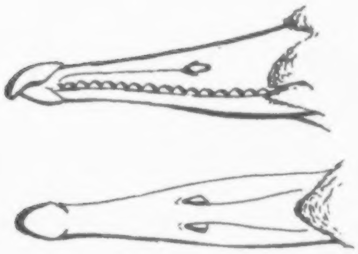
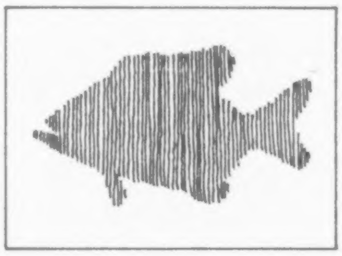
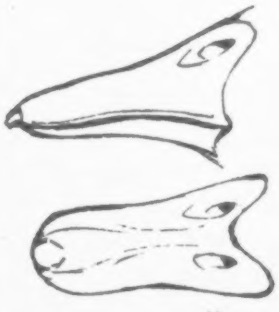
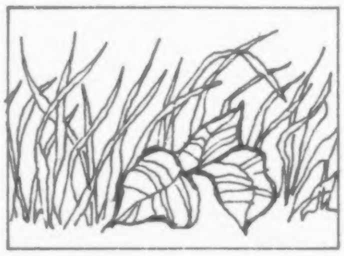
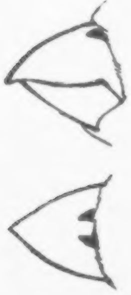
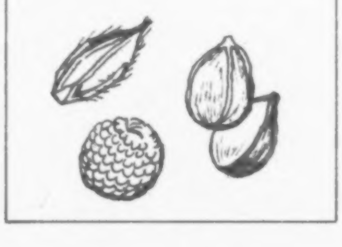
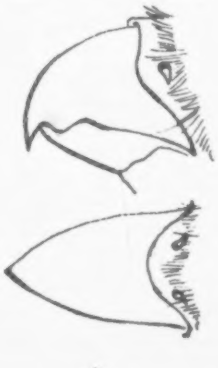
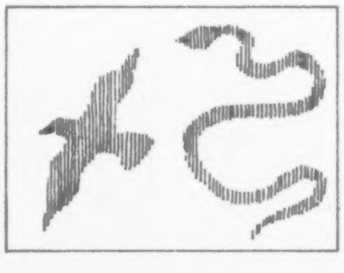
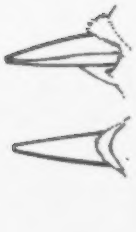
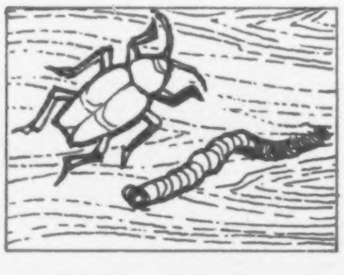
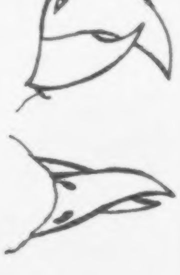
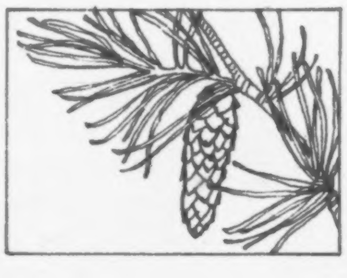




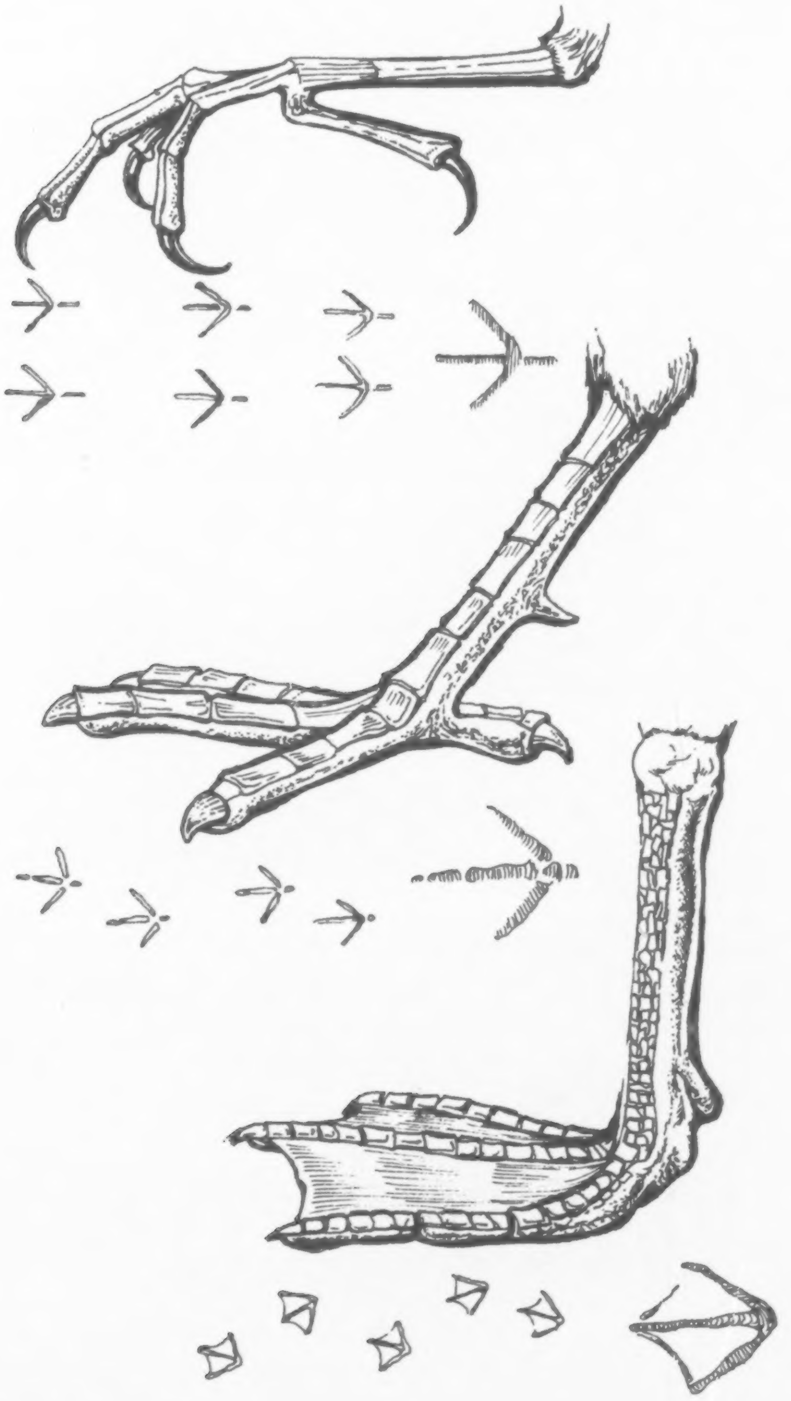


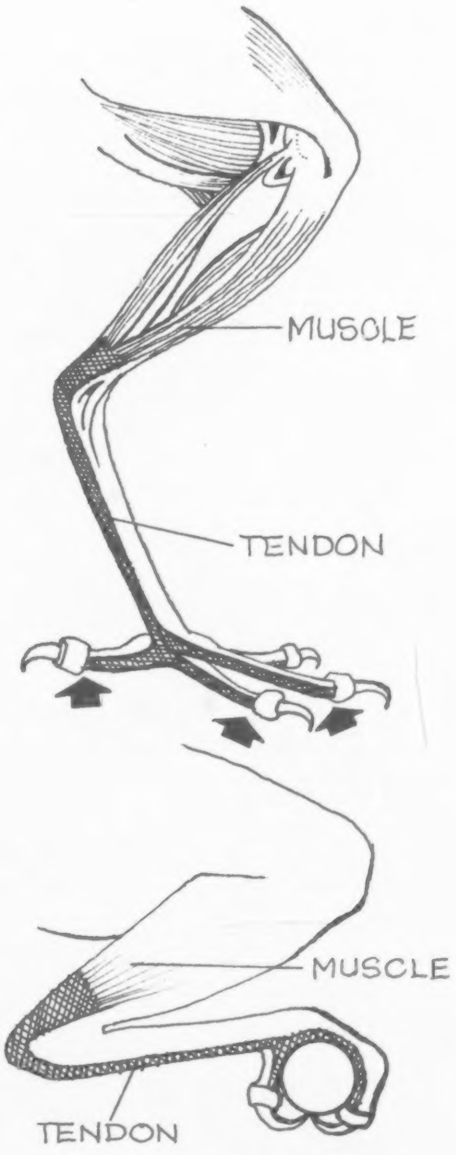


Feeding Adaptation

Beak	Food	Beak	Food
			
			
			

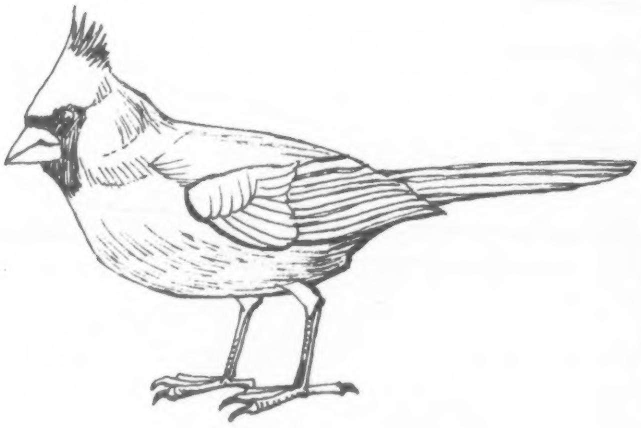
Foot Types

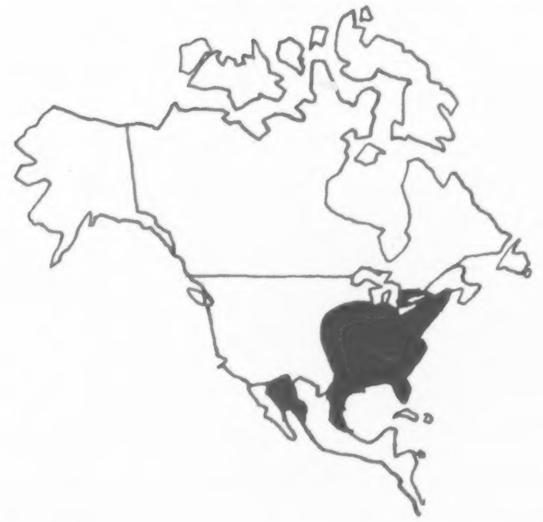




Where are birds found? (Range, Habitat, Territory)

About 8,600 different species of birds are to be found throughout the whole world. Of these, only 650 live in North America. Certain birds are limited in where they are found by oceans, mountains, desserts and climates. Example: Hummingbirds are found only in North and South America because it would be impossible for these midget birds to cross the Atlantic and Pacific Oceans. The total area of the world where a bird is found is called its range. The range of the Cardinal (Richmondena Cardinalis) is shown on the following page.





Each bird is further limited by its adaptations and food needs. Not every part of a range is suited for the bird to be living there. The Mallard duck (Anas Plathyrhynchos) has a range covering almost all of North America. Yet one finds the Mallard only close to water, for which it is adapted with waterproof feathers, webbed feet and shovel-like beak. Mallards are just not found sitting in trees or on city streets or on top of the Rocky Mountains. So we say the Mallard belongs in a water habitat. The habitat of Meadow larks (Sturnella Magna) is wide open fields; for Golden Eagles (Aquila Chrysaetos canadensis) it is mountain valleys; for Red-winged Blackbirds (Agelaius Phoeniceus) it is marshland. So it is with every other bird. It will be found within its range only where the suitable habitat exists.

In a marsh hundreds of Red-winged Blackbirds are to be found, yet each lives in only one small section of that marsh, its own territory. This territory is the bird's home and is shared only with its mate. Here the nest is built, the young are raised and food is found. But how do the birds set up, recognize and defend their territories? The responsibility is largely the male's. He creates a territory firstly by singing. This is done from several specially chosen points on the territorial boundary and tells all others of his species to keep out. If this does not work, then any trespasser will be challenged and chased from the area. A bird's territory is its kingdom.

What is a nest?

A nest is the place chosen or built by a bird in which it lays its eggs. No two are the same in location, shape or size.

For some birds such as the Killdeer (Charadrius Vociferus), the nest is simply a hollow scraped in gravel; for some such as the Screech Owl (Otus asio) and most woodpeckers it is a hole in a tree. But most commonly it is a basket woven by the bird from sticks, feathers, grass or any other suitable material. These baskets range in size from the Hummingbird's "walnut shell-sized" nests, to those of the Bald Eagle (Haliaeetus leucocephalus) which have measured as much as 8 feet in width and 12 feet in depth, and have weighed upwards of two tons.

The placement of a nest is very important for the safety of the bird and its offspring from enemies and weather. It must also be close to a good supply of food.

Because of these facts some birds nest alone and hide their nests with tremendous skill. Even the females of these birds, who do most of the sitting on the eggs, are well camouflaged in dull browns, greys and blacks. The Cardinal is an excellent example of a lone nesting species. Other birds prefer protection in numbers and nest together in colonies. The largest colonies often number several thousand nests. For added protection the colonies are often on islands and cliffs where no predators such as cats or foxes can reach them.

Because of this variation in the form and sites of nests, a great difference is also found in the eggs of the birds. The Killdeer's egg, laid on pebbles, is speckled heavily to blend in with them. Its shape is very pointed at one end so that it can only roll in circles and not out of the nest! At the opposite extreme the Screech Owl's eggs, hidden deep in a hole in a tree, are pure white and perfectly round. Such a nesting site means that no protective camouflage or shaping is necessary. Between these two extremes lie the majority of birds' eggs, shaped in the more traditional form of a hen's egg and coloured in a variety of quiet tones and patterns.

Of what use are birds?

One of the most common ways man uses birds is for food. For example, every year Canadians eat an average of 40 pounds of chicken per person. We also eat hens, turkeys, geese, ducks, pheasants, etc. and large numbers of eggs.

Wild birds are also very important, for they are very effective in getting rid of the millions and millions of insects that descend annually upon farmers' crops. It has been estimated that starlings destroy insects and insect eggs at the rate of 40 per hour for every starling. If this is generally true for all birds we can see that birds keep us from being plagued by insects.

Some birds are also hunters: the hawks, the owls, the kingfishes. They prey on other birds and small animals and so help maintain the balance of nature. Without these predators certain creatures would multiply to such numbers that there would not be enough food to support them and mass starvation of some species would result.

Birds are also useful scavengers. Hawks, gulls, and vultures clean up the dead animals that would otherwise litter the woods, the countryside, and the shoreline.

Birds also provide man with the sport of birdwatching. Today more and more people are trying to see and identify birds rather than destroy them. It can be a thrilling hobby and harmless to all involved. Birds also play a delightful part in everybody's life by singing. The spring chirps of sparrows or the summer songs of robins give pleasure to everyone.

How can man help birds?

In recent years man has come to recognize the value of birds and has taken many steps to help them. Amongst the most useful of these are protective laws. Nobody can trap, hunt or keep wild birds without a special license. As a result birds are left to live naturally and successfully in the wild state. Only certain birds are allowed to be hunted each year and only at times when they are not nesting or in a desperate search for winter foods. The numbers hunted are also strictly controlled. In addition to forming protective laws man has also created many sanctuaries, areas in which birds are protected. Here the birds may nest, feed and rest without disturbance. The Toronto Islands are an excellent example of a sanctuary and are a very important stop-over point for migrants.

The feeding of birds in winter is becoming an increasingly popular hobby of many people. It is one which greatly aids the wintering bird. In times past winter storms killed many birds by covering food supplies. Now food is available even in the worst of conditions. As a return for this kindness birds add a brightness and life to the frozen winter scene.

Another helpful hobby is the building of bird houses. As man has developed the countryside, many nesting sites have been destroyed. To replace these, man now builds bird houses. One example of their success is the increasing population of a once rare species in Ontario — the Bluebird.

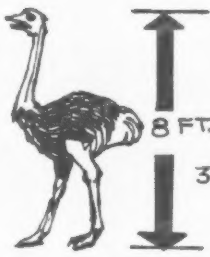
Finally man is becoming aware of yet another way to help birds and all other living creatures. He is beginning to clean up pollution. It comes in many forms, the most dangerous to birds being water pollution and insecticide poisoning. Every year thousands of ducks swim into oil dumped by boats; robins eat grubs covered in insecticides — all are doomed to die one of the most painful, lengthy and unnecessary deaths known. Certain insecticides also affect the eggs of nesting birds. The shells are soft and break when the female sits on them. They never hatch. Many birds of prey and fish-eaters are suffering particularly from this problem and some, because of it, are faced with extinction.

It is man's dream to save them and other creatures by cleaning up much of the cause in the years to come. Hopefully it will be soon enough.

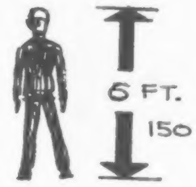
BIRD FACTS

SIZE

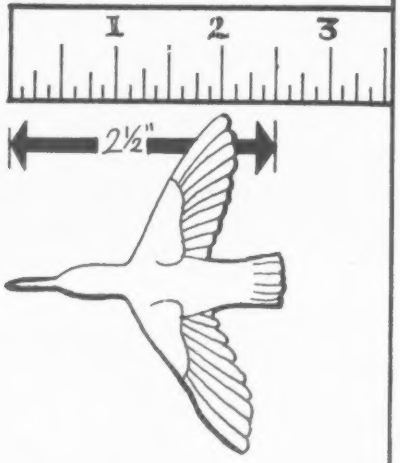
BIGGEST - OSTRICH



MAN

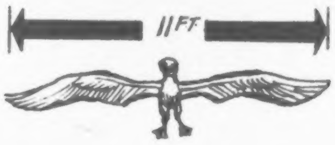


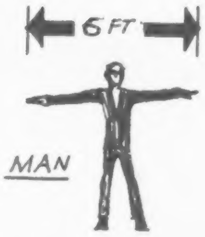
SMALLEST - HUMMINGBIRD



WINGS

BIGGEST - ALBATROSS

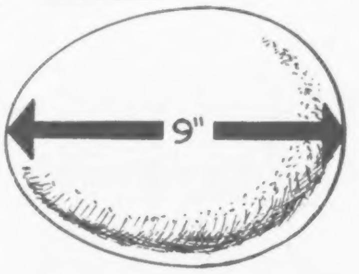




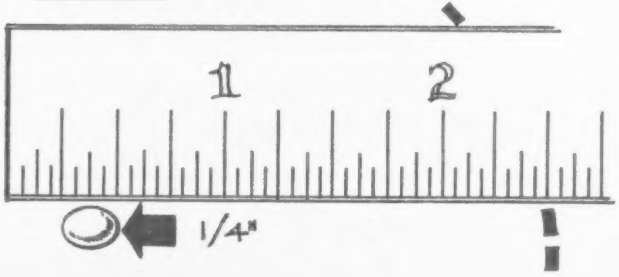
MAN

EGGS

BIGGEST - OSTRICH



SMALLEST - HUMMINGBIRD



1 300 LB. OSTRICH = 48,000 HUMMINGBIRDS.

1 OSTRICH EGG = 5,000 HUMMINGBIRD EGGS.

How Does One Identify Birds?

The following system is simple and with the help of a bird book will give one the identity of many species. It is called the *Six "S" System,* because each of the clues starts with an "S".

---

1. Size: of great importance, it immediately separates possible birds from impossible, e.g., sparrow from goose.
2. Shape: many birds are grouped by rough shapes, e.g., ducks and hawks.
3. Sound: every bird has a special recognizable song.
4. Sight: the colours and marks you see on the bird.
5. Site: where you find the bird.
6. Season: when you find a bird (some are not here at certain seasons).

All the additional equipment needed for birdwatching is a pair of binoculars (not necessarily expensive!)

Books and Clubs for those interested

Books

A Field Guide to the Birds: R. T. Peterson, Houghton Miflin Co.
Birds of North America: C. S. Robbins, Golden Press
How to Know the Birds: R. T. Peterson, Signet Key Books
Birds of Canada: W. E. Godfrey, National Museum of Canada

Clubs

Young Naturalists Club (Magazine $1.00/yr)
Suite 49, 1262 Don Mills Road
Don Mills, Ontario

Toronto Junior Field Naturalists
Royal Ontario Museum
— Saturday mornings
— hikes and indoor activities.

FOLLOW-UP ACTIVITIES

1. Toronto Island is an excellent sanctuary for birdlife. One of the major reasons for this is the number of *habitats* available for birds to nest and feed in.

   a. Name three types of habitat you saw.
   b. Name one bird that lives in each.
   c. What food would they eat?

	Habitat	Bird	Food
1.			
2.			
3.			

2. In the chart below place the following facts (Use a bird book for help)

   a. three species of birds you saw this week
   b. the season you saw them in
   c. the North American range of the species (shade in on the map)

Species			
Seasons			
Range			

   d. Where do these birds live during seasons in which they are not seen at the Island?

____

____

____

3. a. Illustrate below 2 types of bird feeder you saw at the Island.
   b. Tell what type of bird might use each one.

1. 2.

____________________ ____________________

4. If a bird is not a winter migrant it would have to adapt to the cold and snowy conditions. Below is a list of possible adaptations. Which four are truly adaptations for winter? (Mark T-true or F-false)

_____ a. Birds increase the fat reserves on their bodies.
_____ b. Birds find feeders close to where they live.
_____ c. Birds grow new feathers to cover their legs and feet.
_____ d. Birds stay in holes in trees on really cold days.
_____ e. Birds change the foods they eat.
_____ f. Birds form flocks to share the available foods.

5. List four uses of feathers to birds.

1. ____________________
2. ____________________
3. ____________________
4. ____________________

6. a. What is a predator?

____

____

b. Name a predatory bird.

____

c. What are two uses of predators in nature?

1. ____________________
2. ____________________

7. Give three reasons for scientists to band birds.

1. ____

2. ____

3. ____

8. Illustrate two methods of trapping birds without harming them.

1. 2.

9. Name and draw two other creatures that scientists "band" for study.

1. 2.

10. How else might a scientist identify birds for study?

____

____

11. In a short paragraph tell why man should protect bird life in the world.

____

____

____

____

What is banding all about?

Banding is a scientific way of marking birds for study.
It answers questions such as:

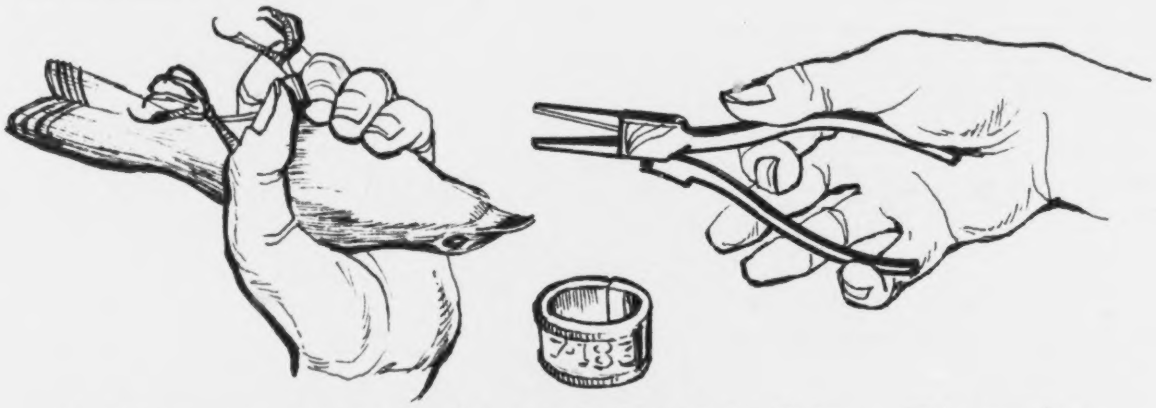
Where does a bird travel?

Does it spend the winter in the same area each year?

How long do birds live?

Are the same routes used in migration each year?

The method is simple. A licensed bander sets a variety of traps from nets to cages designed to catch the birds alive. When a bird is trapped, one of the 14 recognized sizes of bands is selected and placed upon the bird's leg as illustrated.



On the band is a number, which only that bird will have. This number will immediately identify that bird if it is ever found again, after being set free. The bander also keeps careful records of:

a. band number
b. species of bird
c. location of banding
d. date of banding

These records are sent by Canadian, American and Mexican banders to Washington, D.C., U.S.A. where they are stored in computers.

Anyone who finds a bird that is banded should *send the above information and his own address to:*

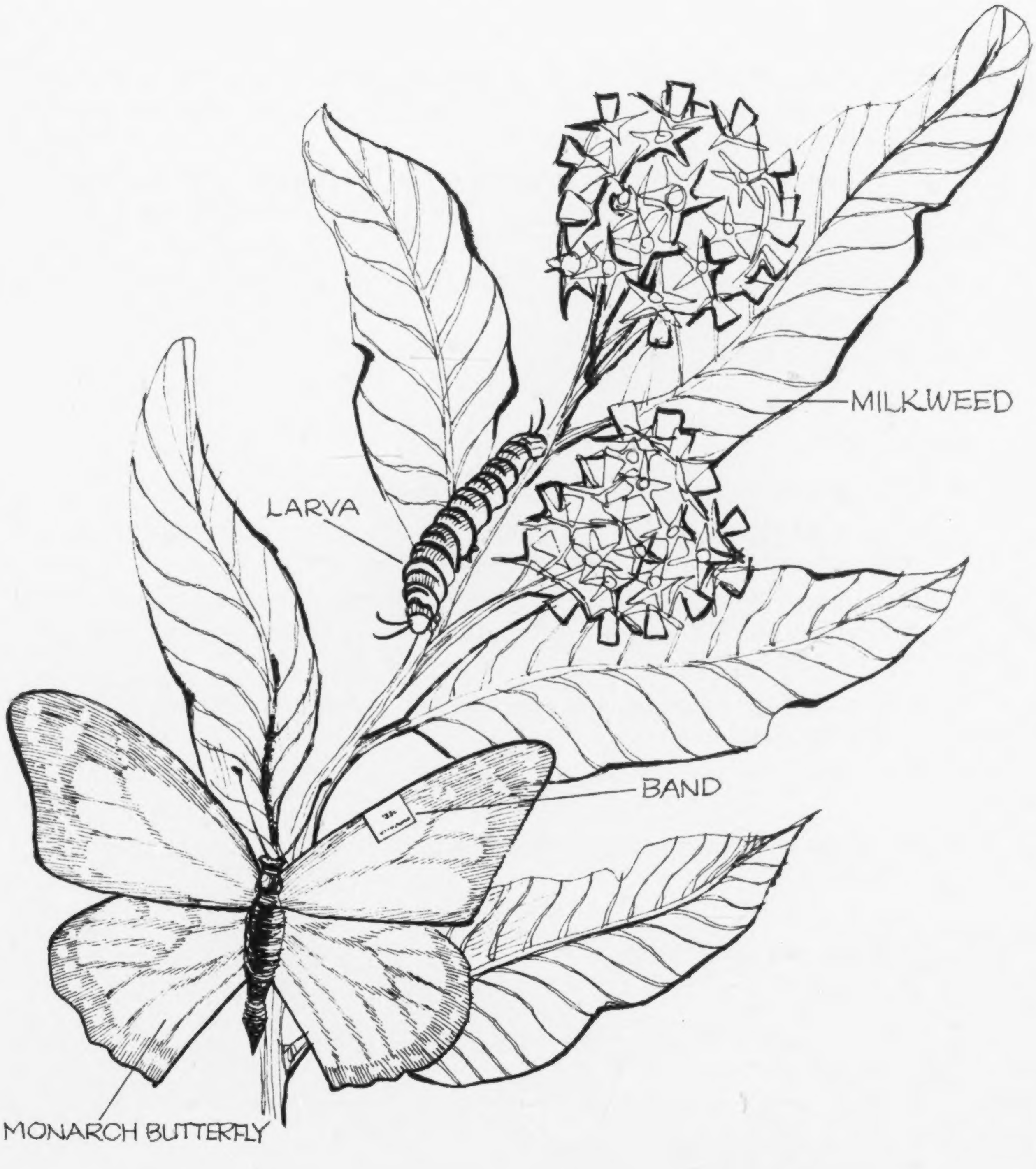
Fish & Wildlife Service
Washington, D.C.
U.S.A.

In doing this, he will help scientists greatly in their studies. He will also be sent a card telling him about the banded bird.

Some interesting facts learned from banding birds.

1. A shorebird, the Lesser Yellowlegs (Totanus flavipes) banded at Cape Cod, U.S.A. on August 28, 1935 was killed 1,930 miles away on the island of Martinique, West Indies, 5 days later. It flew an average of 386 miles a day.
2. A Caspian Tern (Hydroprogne caspia) lived for 26 years after being banded.
3. A Purple Martin (Progne Subis) returned to the same nesting box for 7 years.

MONARCH BUTTERFLY



Every fall thousands of Monarch Butterflies pass over the Toronto Islands on their way to the southern parts of the United States. Pupils visiting the school during this time capture these delicate insects and carefully glue a small paper band on their wings. The majority of these banded butterflies are never heard of again. We did have a recovery of a butterfly banded here on September 19, and found less than one month later, on October 15, on a beach in Destin, Florida, a distance of over 1200 miles.

HOME ACTIVITIES

FIELD TRIPS

1. Select an area close to home. Hike around it at each season and record what birds you see. Do this also at several times during a day. You will find when the birds are most active, where they feed, where they rest and much else.
2. Make a map of your neighbourhood and mark upon it the territories of different pairs of birds (e.g. Robins, Cardinals, etc.). To do this you will have to carefully note where a male bird does his singing. This marks territorial borders.
3. Make a collection of nests, but only in wintertime when you can be sure they are not in use.

Activities

a. List all the materials you can see the bird has used.

b. Take a nest apart carefully and count the pieces used. Remember that each piece often requires a special flight by the bird.

c. Measure the width and depth of the nest to estimate the builder's size. (The bird sits on the eggs inside the nest.) Relate this to the habitat in which it was found and try to identify the builder.

d. Nests are built in different locations. See how each is specially designed for its placement.

e. What other creatures can you find making use of Nests?

To keep nests tidily use old shoe boxes which are ideal as storage compartments.

Materials bird uses in nest

____

____

____

____

____

____

____

____

FIELD RECORD OF BIRDS

	Species	Date	Habitat	No. seen
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

* **NOTE** Keep records of this type for the birds you see in the city or on trips in the country. After a while, you will have an interesting and informative list.

FIELD RECORDS OF NESTS

Nest Site

Materials and construction

No. of eggs

Shape of eggs

Hatching date

Leaving date

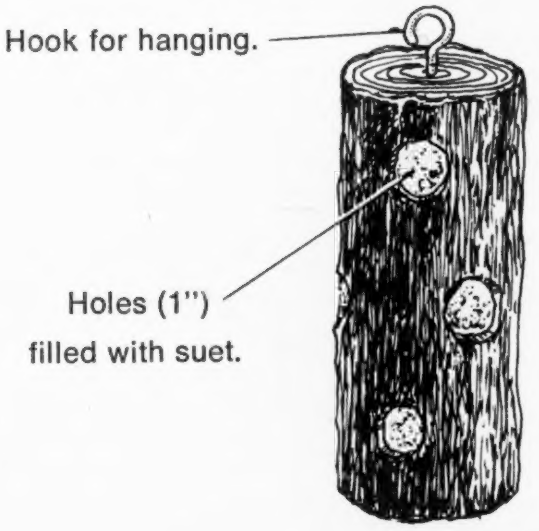
Number of young to leave nest

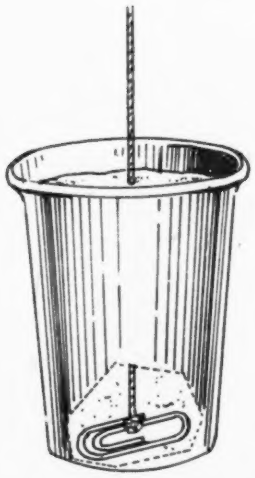
4. Start a feeding station. All you need is some seed placed out in a sheltered area. If you wish you may then build or buy feeders at a later date. Do not expect birds to come immediately. They have to discover the food first.

The following page gives some ideas for feeders you can build.

FEEDERS

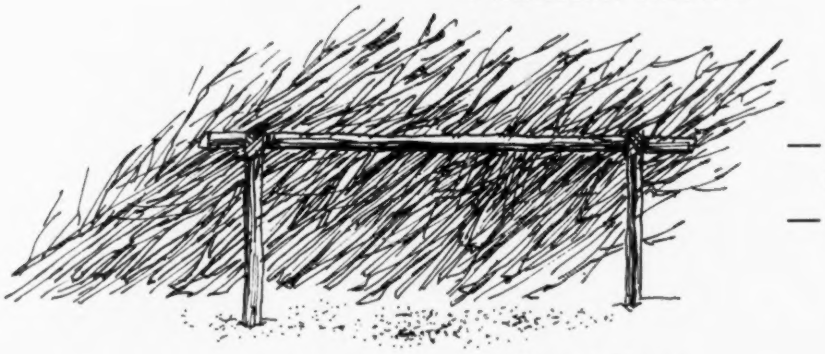
Woodpecker's


Hook for hanging.
Holes (1")
filled with suet.



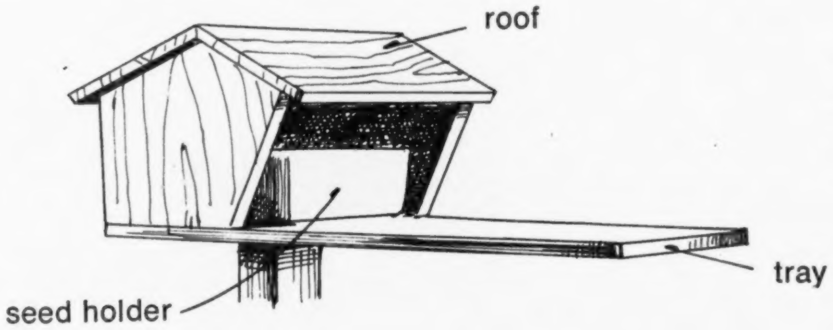
Cup molded suet, — pour melted suet into cup with a string and a paper clip suspended in it. When hard remove and hang up.

Pheasant Shelter



— a lean-to about 1½' — 2' in height made of dead brush
— scatter seed beneath

Seed Trays


roof
tray
seed holder

Essentials of a feeder:

- a tray for birds to feed on
- a holder for seed
- a roof to keep seed dry

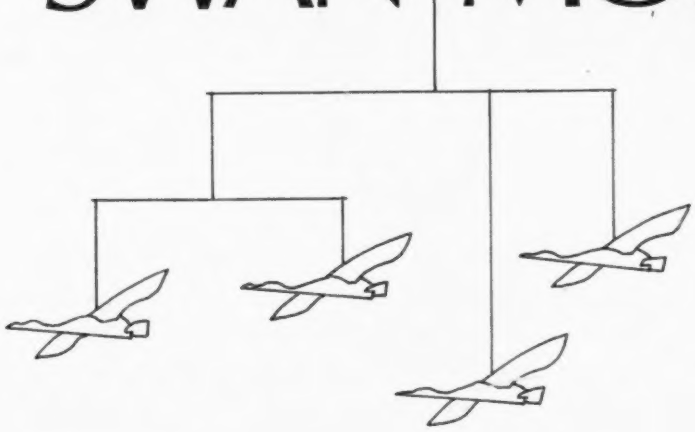
Remember! — Birds are not fussy about where they eat. Survival is their concern; it means finding a steady food supply.

Once you start - Don't stop, till winter is gone!

HOME ACTIVITIES

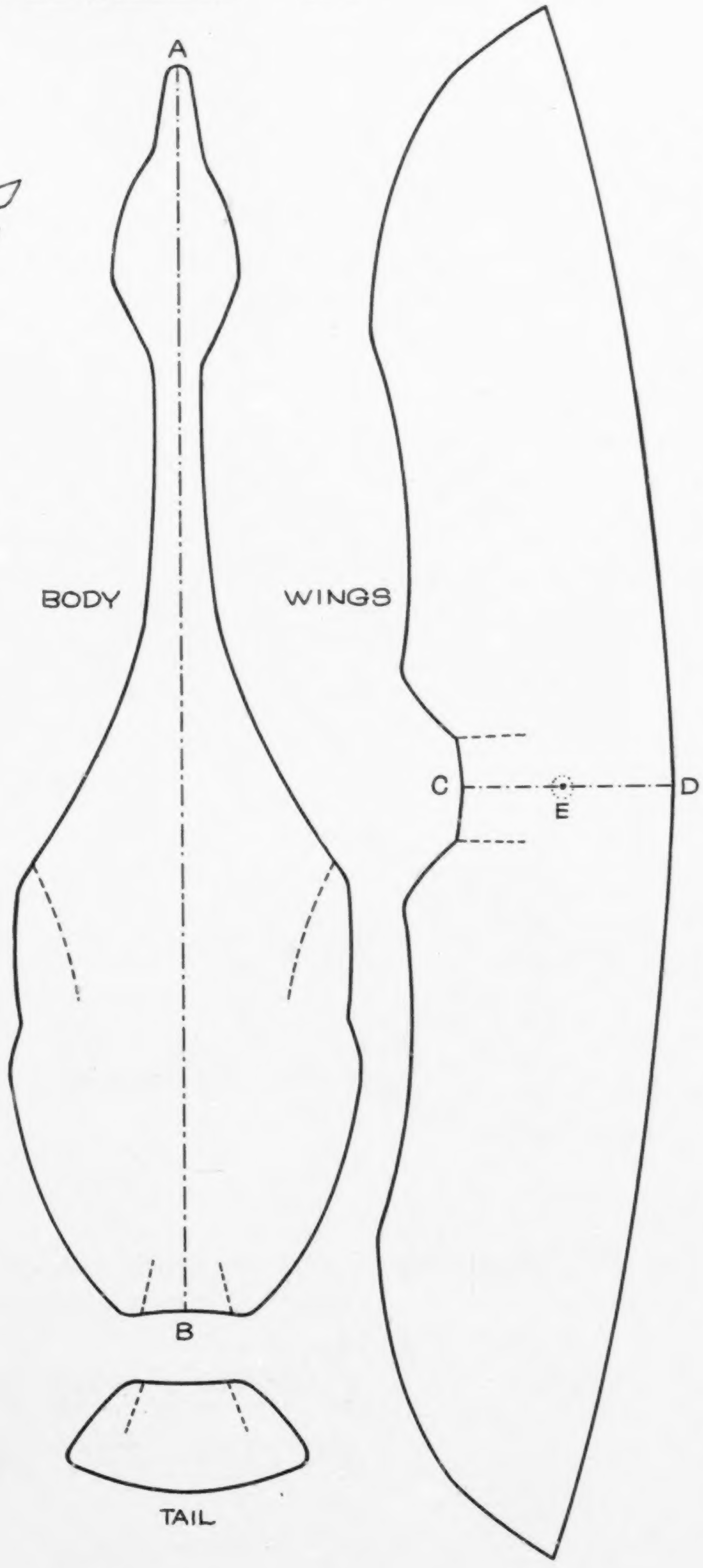
MAKE A FLYING SWAN MOBILE.

Materials needed:
scissors
thin white cardboard
thread
coat hangers
glue

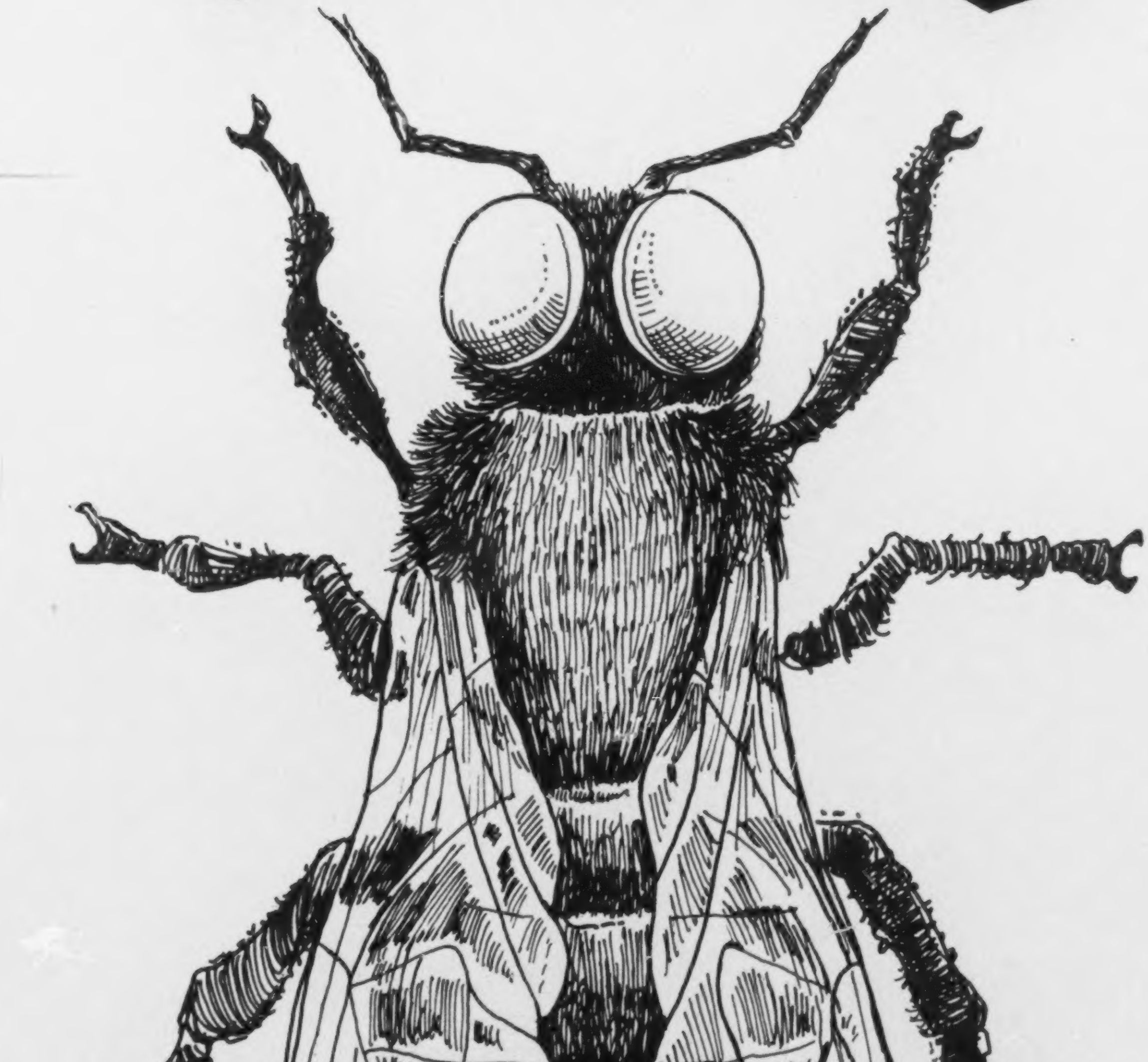


Instructions:

1. Trace the patterns on the following page onto the cardboard and cut them out. Do as many sets as the number of birds you wish to have.
2. Fold the body lengthwise along line A, B and the wings along C D. Punch a tiny hole at E.
3. Cut all other dotted lines.
4. Folding the body, fit the slots on the wings into the long body slots. Repeat for the tail.
5. With a needle, pass a length of thread through the hole at E. Tie a knot in the end of the thread and glue it to the wings. Cut off the other end at the desired length.
6. Hold the thread and adjust the tail and wings till the mobile balances. Glue the wings and tail in place.
7. Repeat the above for each bird needed.
8. Cut the wires needed and straighten them. Tie the birds to them, and the wires to each other.
9. Hold the main thread and adjust the birds and wires till the complete mobile balances. Glue the threads in place and hang it up. If you wish, try designing your own birds for a mobile.



BEES



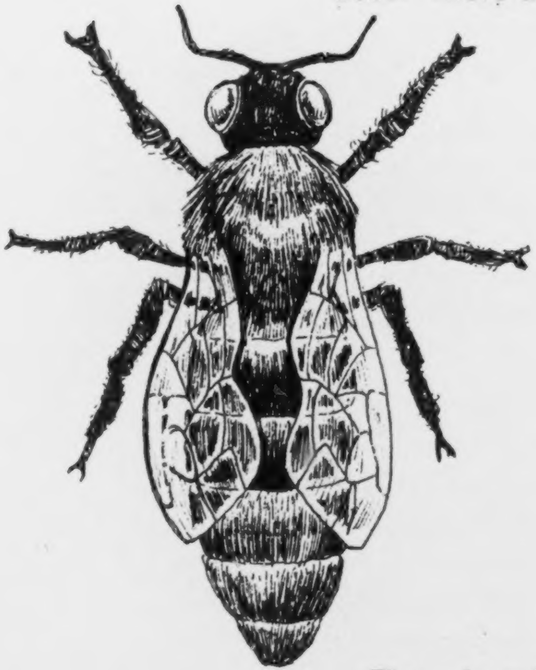
BEES

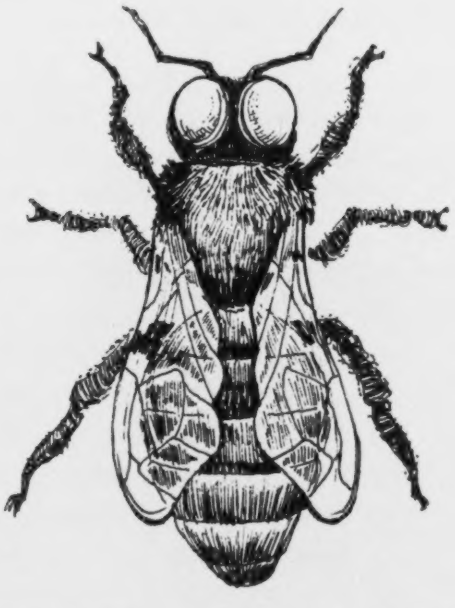
Many plants have flowers to produce seeds which will reproduce the plant the following year. In order to produce the seed, the flower has two important parts. On one is produced the powdery pollen. On the other is produced the sticky stigma. Nature has separated these two parts. But in order to produce a seed, nature must get the pollen to the stigma. One purpose of the flower is to attract insects. The insect sees the flower and flies down to investigate. When the insect goes in to reach the nectar, some of the pollen sticks to its body. As it crawls over the sticky stigma, this pollen adheres (to the stigma) and leads to the development of a seed. This is called pollination.

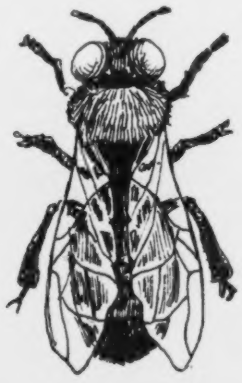
Insects have six legs and three body parts: the head, thorax and abdomen. To the thorax are attached the six legs. If the insect has wings, they are attached to the back of the thorax. In the abdomen are the stomach and breathing apparatus. In each segment of the abdomen are little holes called spiracles, through which the insect breathes.

Insects have either three or four stages in their life cycle. If they have four, they are egg, larva, pupa and adult. The adult lays the egg. The egg hatches into the larva which is the eating stage of the insect. The larva is often called a caterpillar or grub. When it is finished eating, it goes into the pupa stage. This is when it builds a house around itself, sometimes called a cocoon or chrysalis. From the pupa hatches the adult.

Bees have all these characteristics; they are a true insect. They are one of the few insects that are beneficial to man. There were no bees in North America until the coming of the white man. He imported them from Europe. The wild bees that we have today have escaped from the bee-keeper. At certain times of the year, a beehive may become over crowded. Then the bees will swarm. If the bee-keeper is busy and does not recognize that they are going to swarm, they escape away from the hive and are known as wild bees. There are three kinds of bees in the hive: queen, drone and worker.







There is only one queen to a hive. She is a very jealous queen and will allow no others. If more than one queen is born, they will fight to the death when they meet. The drones are the male bees. They usually number between one hundred and three hundred. An average hive has forty thousand workers. A small hive may have ten thousand. It is not until the hive has sixty to seventy thousand that the bees will swarm. A swarm of bees may have from fifteen to twenty thousand.

The queen is hatched from the very same egg as the worker. But when a new queen is needed, they go to where the worker egg has been laid and enlarge the cell. The cell has to be enlarged because the queen bee is so much larger than the worker bee that she could not be raised in an ordinary cell. When the egg hatches into the larva the nursemaid bees feed it royal jelly for the six days that it is a larva. Then it goes into the pupa stage from which she emerges as the large queen bee. The queen is about three times as large as an ordinary bee with a long pointed abdomen. After she is hatched she rests for about six days, then she feels that she must go on her marriage flight. She waits for a warm still day and then flies up into the sky. This is the moment for which the drones have been waiting. The strongest one will get to the queen first and mate with her. In this way nature sees to it that the queen will have the strongest drone for her husband so that she will have strong children and a strong hive. After she has mated with the drone, she flies back to the hive and again she rests for several days. Then she starts her life long job of laying eggs. The queen is able to lay between one thousand and two thousand eggs a day. (In her lifetime she may lay up to a million eggs.) She is so busy laying eggs that she has no time for herself. She has a group of nursemaids following her about who are continually brushing, combing, washing and feeding her royal jelly. This is her only food. She is able to lay two kinds of eggs — (a) fertile eggs and (b) unfertile eggs. The fertile eggs hatch into workers or, if needed, another queen. The unfertile eggs hatch into drones who are not as large as the queen but are about twice as big as a worker. They are born with such small mouth parts that they can not reach into a flower far enough to get any nectar or pollen, so they must be fed by the workers. They are also born without a stinger and cannot fight or defend themselves. They never do a day's work in their lives. (Hence the expression, "as lazy as a drone.") The only use for the drone is the one, to fertilize the queen. Along about October of each year, the workers push the drones out to starve or the executioner bee stings them to death.

The worker is born from a fertile egg, is fed royal jelly for three days and then bee bread for three days. (Bee bread is a mixture of pollen and honey.) The larva goes into the pupa stage and when she emerges she is the hairy little worker. She labours so hard that she works herself to death in about six weeks. The queen bee might live from one to five years. The drone lives five to six months. A worker bee has many jobs in her lifetime, including:

(a) housemaid to clean the cells for eggs or honey.
(b) nursemaid to produce the royal jelly for larva and queen.
(c) porter bee to store the nectar and pollen in cells.
(d) wax maker to produce wax to make and cover cells.
(e) cell maker to fashion six-sided cells.
(f) guard to keep out robber bees and other insects.
(g) food collector to gather nectar and pollen.
(h) fanner to evaporate water from nectar and keep hive cool in hot weather.
(i) executioner bee to get rid of the drones.
(j) undertaker to remove dead bodies from hive.

The bees make and store honey to live on during the winter. Some honey is used in the summer for feeding and to make wax. The bees usually work so hard that they store more honey than they can use. The bee-keeper takes this excess honey. Man uses honey for food, medicine and baking.

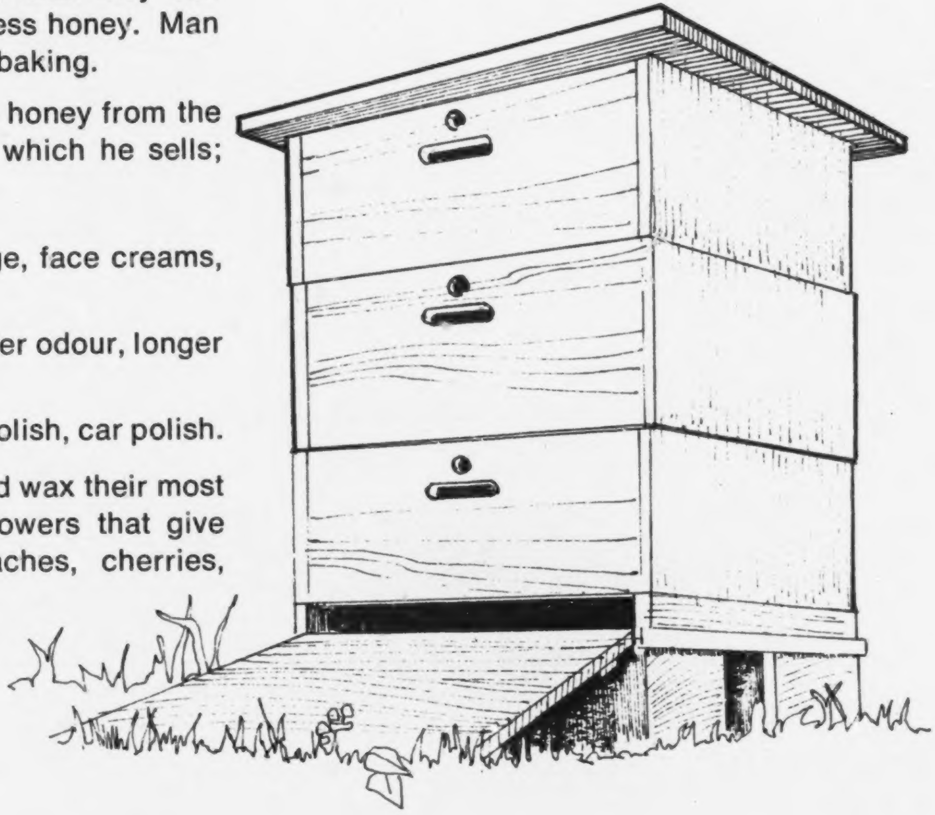
When the bee-keeper extracts the honey from the cells he is left with the bees' wax which he sells; it has many uses:

(a) cosmetics such as lipstick, rouge, face creams, hand lotion

(b) candles which burn with a sweeter odour, longer and brighter

(c) polisher — floor wax, furniture polish, car polish.

While bees do give man honey and wax their most important job is to pollinate the flowers that give us food, e.g. apples, pears, peaches, cherries, grapes, etc.



FOLLOW-UP ACTIVITIES

1. Why do many plants have flowers?

____

____

2. How are some flowers pollinated?

____

____

3. How would you identify an insect?

____

____

____

4. Name four stages in the life cycle of an insect.

1. ______________ 3. ______________

2. ______________ 4. ______________

5. How did bees arrive in North America?

____

____

6. How do you account for wild bees in North America?

____

____

____

7. Name the three kinds of bees in a hive.

1.__________ 2.__________ 3.__________

8. Give the duties of each.

____

____

____

____

9. For what reason do bees make honey?

____

____

____

10. How does man use honey?

____

____

11. How does man use bees' wax?

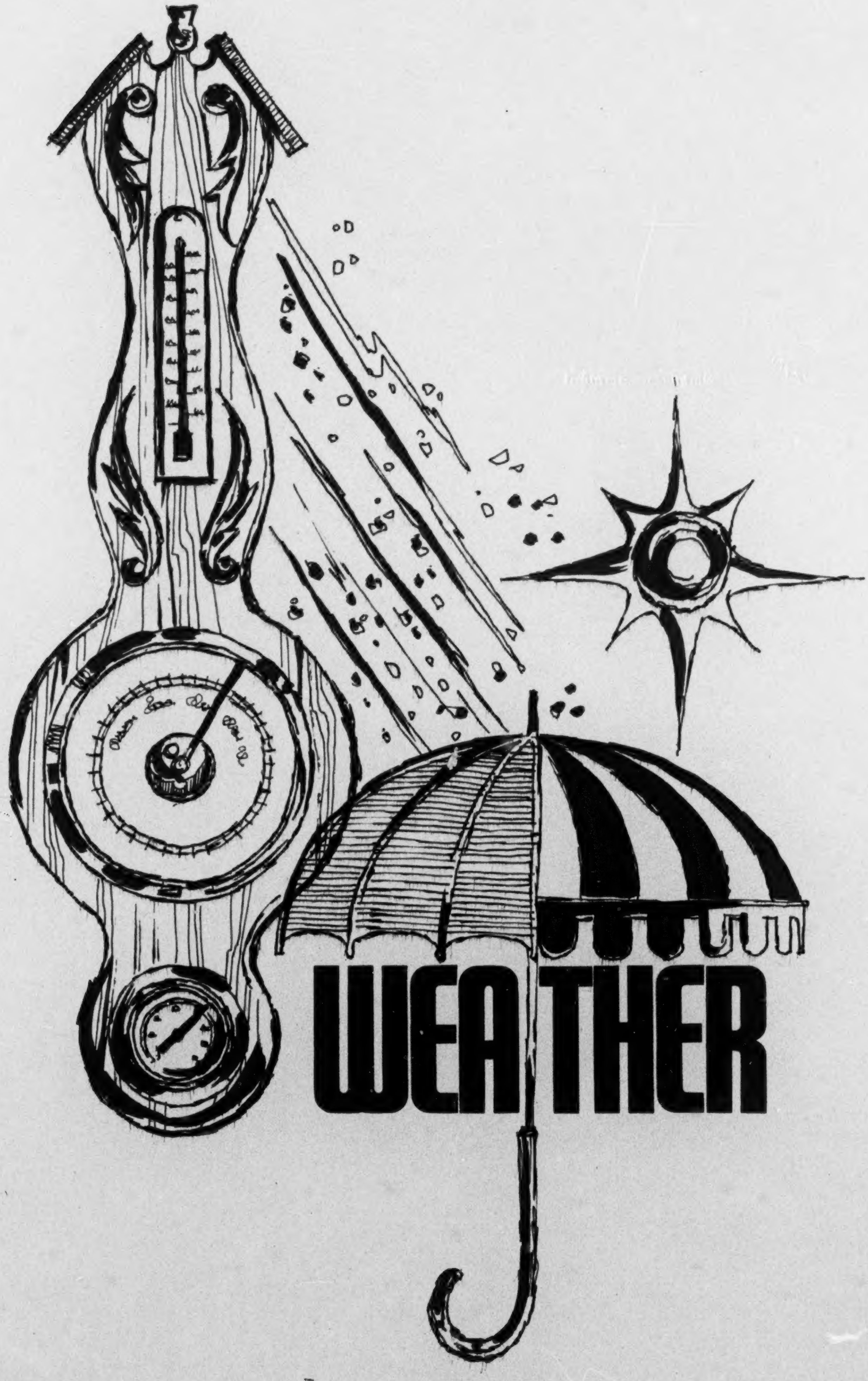
____

____

12. To man, what is the most important job of the bee?

____

____


WEATHER

WEATHER

WEATHER AND WEATHER FORECASTING

Weather is always with us. Our activities and our health are all affected by weather. Some effects are very subtle and may even pass unnoticed. We all have felt our spirits lift with the appearance of the sun on a dull cloudy day, or felt pessimistic as a storm approached. Since we can do very little about weather, we learn to adjust ourselves and live with it. This is where meteorology, the science of weather, plays an important role. The weather forecast helps us to be prepared for what is in store for us. Knowledge of meteorology can be useful.

Name five occupations that might be affected by the weather?

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

Why Weather?

Weather is caused by the changes that take place in the blanket of air around our planet called atmosphere. These changes are greatly influenced by the sun. Temperature, pressure, wind and moisture affect weather which is always changing. Our weather over a long period of time is called climate.

How To Study Weather?

In the next few pages we shall look at the five main factors in our weather: (a) temperature (b) humidity (c) clouds (d) wind (e) air pressure.

WEATHER — PART 1: TEMPERATURE

Temperature

The source of our heat on earth is the sun. This gigantic mass of glowing gases bombards the earth with 126 trillion horsepower every second. Only about 4/10 of all the heat we receive from the sun is absorbed by soil and animals; the rest remains in the atmosphere or is reflected back into space.

Temperature changes from hour to hour, from day to day, and from season to season. The amount of heat we receive at a particular time or place is largely determined by the sun's rays and the slant of these rays as they pass through the air. The more nearly at right angles the sun's rays strike the earth's surface, the greater the heat.

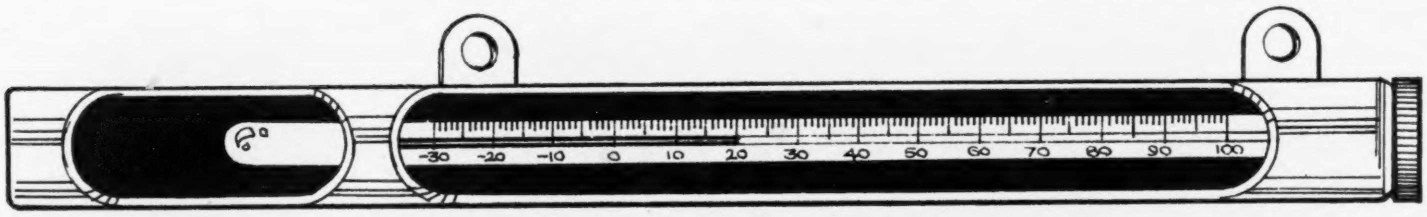
How Does Temperature Affect the Winds, Humidity and Air Pressure?

1. *Winds* occur when the earth is heated unequally by the sun. Warm air rises; this is known as a rising air current. Cold air descends; this is known as a falling air current. This gives rise to high and low pressure areas. The air in the high pressure area will move to the low pressure air to try and equalize the pressures. This horizontal movement of air may vary from a light breeze to a heavy wind.
2. The warmer the air, the more moisture (as water vapour) it can hold. This is known as HUMIDITY. When air rises it cools. When the temperature of the moist air drops to a point where the water vapour can change into droplets and clouds are formed.
3. Changes in AIR PRESSURE are caused by the circulation of hot and cold air, and the resulting rising and falling of air.

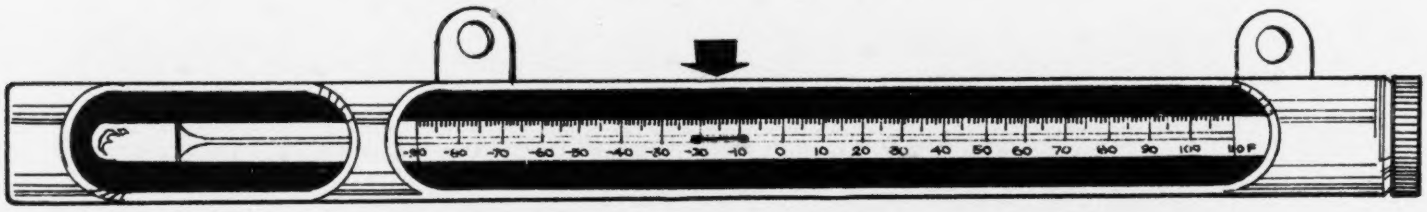
How To Measure Temperature

Temperature is measured with a thermometer.

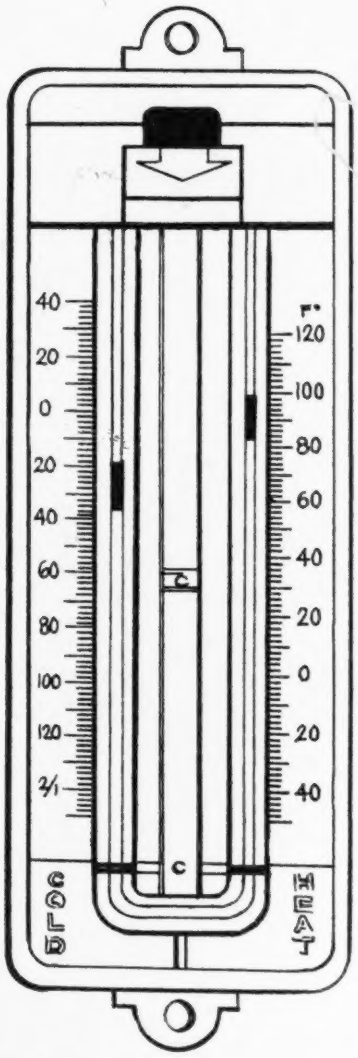
1. *Simple* — This is the usual type of thermometer with which you are familiar. Usually it is filled with mercury. When the temperature rises the mercury expands and climbs inside the tube. When temperatures are cooler, the mercury contracts and retreats down the tube.



2. *Minimum* — The surface tension of the alcohol in the tube serves to pull the small bar down to the lowest temperature. This is reached as the alcohol contracts because of the cold.



3. *Maximum-Minimum* — As the temperature rises, the bar is pushed up the tube until the maximum temperature is reached. As the air cools the mercury drops on the maximum side forcing the mercury up on the minimum side. The mercury here pushes the bar up to the lowest temperature which is near the top due to the reversed calibration on this side.



WEATHER — PART 2: HUMIDITY

Humidity

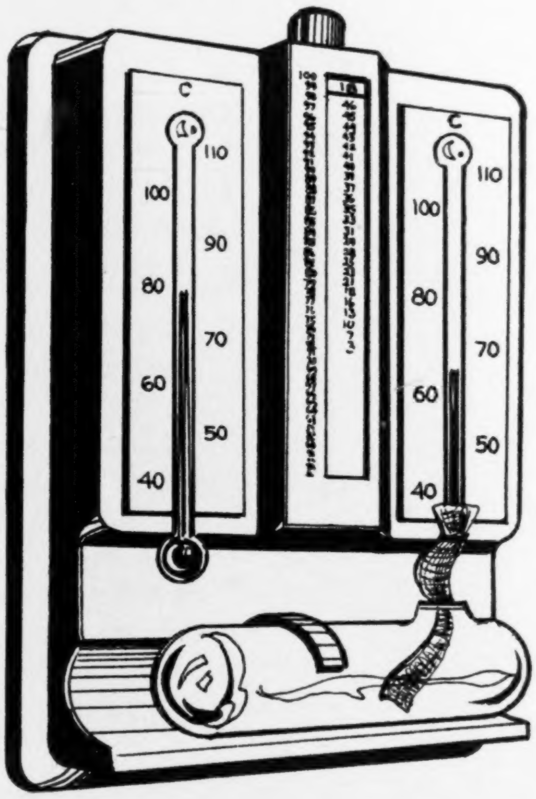
Water vapour is always in the air, even on the driest of days. This water is evaporated by the air from four main sources. Name these four:

1. ______________________

2. ______________________

3. ______________________

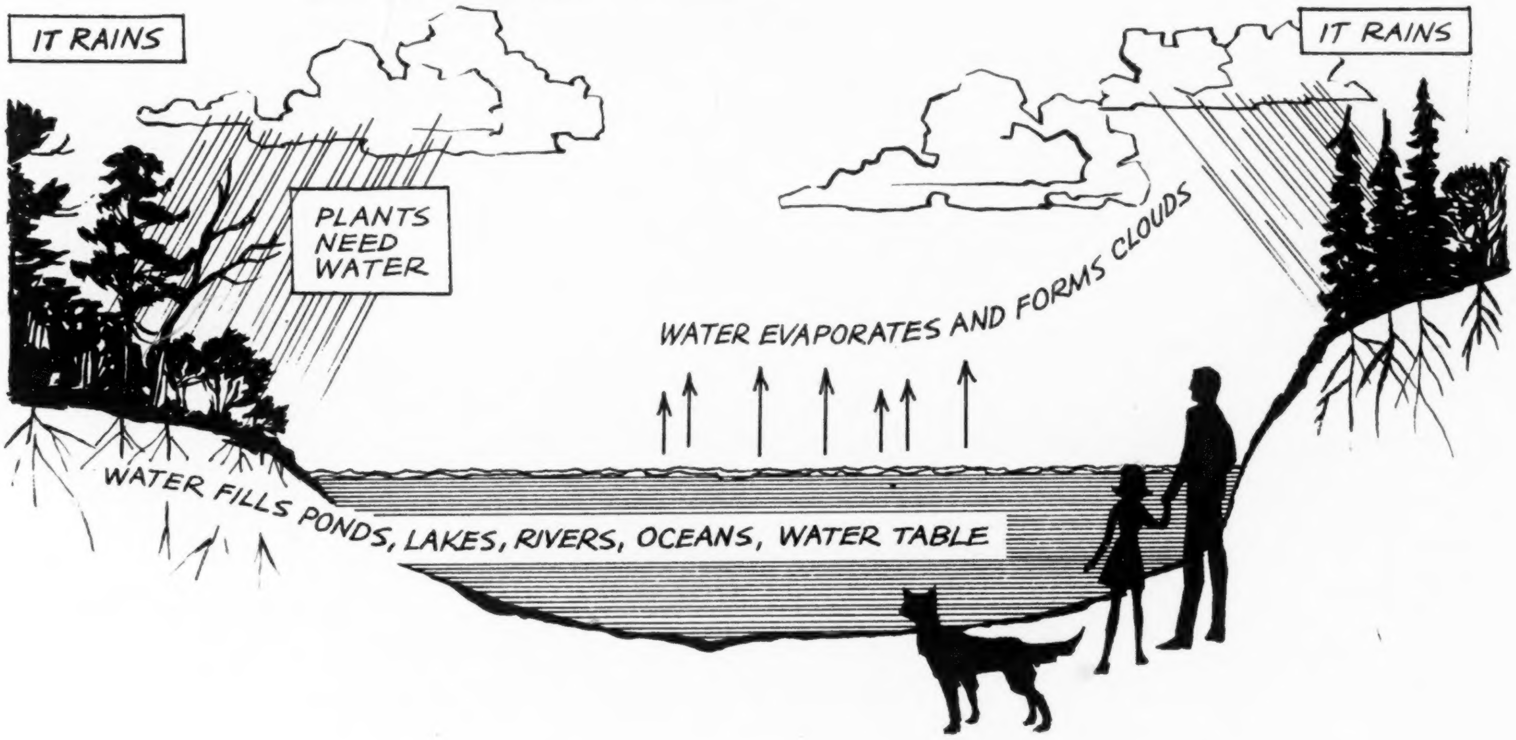
4. ______________________



Humidity is the amount of water vapour in the air. When we speak of *relative humidity* we mean, the amount of water vapour in the air compared with the total amount that the air might contain at that time and temperature. *Precipitation* is the water returning to the earth again as rain, hail, snow, sleet, etc. When *dew* appears on your lawn this means the air layer close to the earth has cooled, causing the water vapour to condense (change from gas to a liquid).

The Water Cycle

Below is a picture of the water cycle. Can you find the correct labels for the drawing from this list of words: precipitation, clouds, water, ground, evaporation, plants, animals.


IT RAINS
IT RAINS
PLANTS NEED WATER
WATER EVAPORATES AND FORMS CLOUDS
WATER FILLS PONDS, LAKES, RIVERS, OCEANS, WATER TABLE

WEATHER — PART 3: CLOUDS

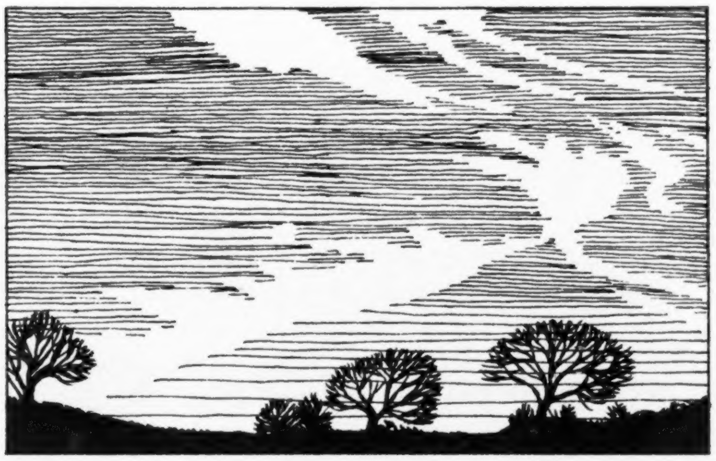
Clouds

When air rises, it cools. We have already seen that the amount of water vapour this air can hold depends on its temperature. When the air holds all the water it can, it is said to be *saturated.* Clouds are formed when this saturated air cools, and the moisture condenses into tiny droplets which form around particles of dust in the atmosphere. If the cloud becomes cooler, it cannot hold as much moisture, which means that rain, sleet, hail or snow may result.

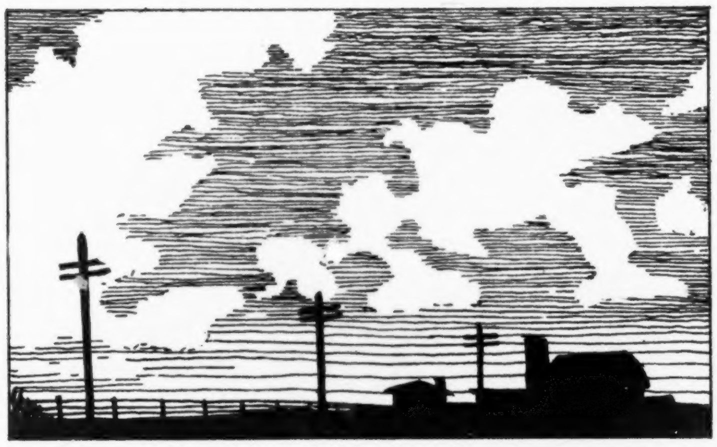
Cloud Types

1. *Cirrus Clouds*
   these are the highest of clouds. They are 25,000 ft. and higher and made entirely of ice crystals. They appear thin, wispy, or feathery, and fortell an approaching storm.

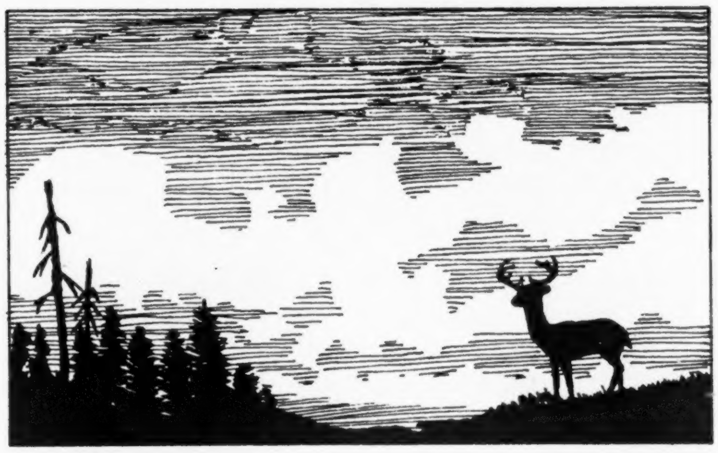
Draw These Clouds



2. *Cumulus Clouds*
heaped or piled up, these are white fluffy clouds, flat at the bottom, but rounded at the top. They usually form in the day, and disappear at night and are referred to as fair-weather clouds.



3. *Stratus Clouds*
these are spread-out clouds appearing as a low sheet with layers. They give the sky a hazy or milky appearance. When they are dull gray, they may even produce a drizzle or slow moving rain.



Try Drawing These

4. *Nimbostratus Clouds*
these are low layered dark-gray rain clouds. They are slow moving and usually remain in the skies over long periods; they usually produce a slow driving rain.

5. *Cumulonimbus Clouds*
these clouds are tall mountainous clouds that can measure four or more miles from top to bottom. Dark gray in colour, they are a source of violent storms, such as thunderstorms. They are referred to as thunderheads.

What Makes It Rain? Hail? Sleet? Snow?

1. Rain falls from the clouds ~~becau~~because of the earth's gravity. Not all clouds produce rain. Why? The clouds with very tiny water droplets and ice crystals are not affected by gravity. Not all precipitation falls as rain. It may fall as snow, sleet, hail. Let us look at how these types of precipitation are formed.
2. *Snow* is formed in the atmosphere when the temperature is below 32°F. or 0°C.
3. *Hail* is formed when rain as it is falling is carried by an up-current of air to a greater height and there frozen. This procedure may occur many times before the hail finally falls to earth.
4. *Sleet* is caused by the rain partially freezing as it falls. It may also refer to a mixture of hail and rain or snow and rain.

An average cloud droplet is only 1/2500 inches in diameter. Before it can fall it must grow to a size of 1/125 inches or larger. The average rain droplet contains *a million* times as much water as a tiny cloud droplet, and thus it will take a while before it can fall.

How To Measure Humidity And Rainfall

You can learn how to build a simple *hygrometer,* an instrument to measure humidity. See the page of instruments. Rain is measured with a *rain guage* which can be easily constructed.

WEATHER — PART 4: WINDS

Winds

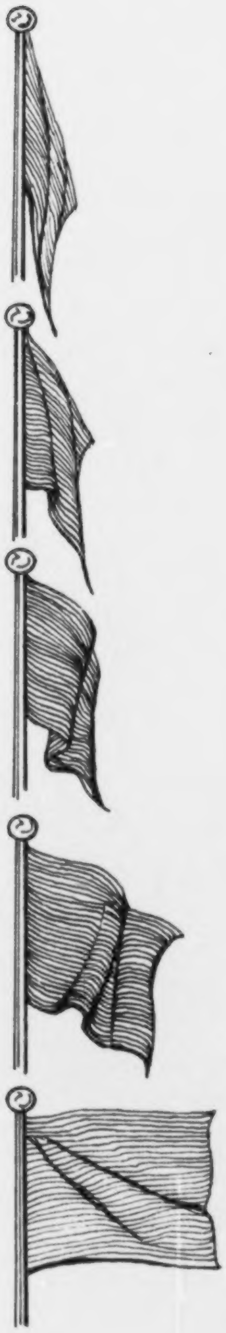
Anyone who understands the wind has a key to the weather. Wind is air moving *horizontally.* When air moves up or down it is usually referred to as a *current of air.* Winds are named for the direction from which they come. The arrow of your wind vane points in the direction from which the wind is coming.

Winds move the weather. The main factors that produce winds are: the rotation of the earth; the great extremes of hot and cold between the equator and the poles; the unequal heating of land and water; and certain land formations such as mountains.

Differences in air pressure cause wind, as when the movement of air travels from regions of high pressure to regions of low pressures. The greater the *difference* of these high and low pressures, the *stronger* the wind.

How To Measure Wind Speed And Direction

Wind speed and direction is measured with an *anemometer* but you can easily use a flag, trees, etc. and the following table:



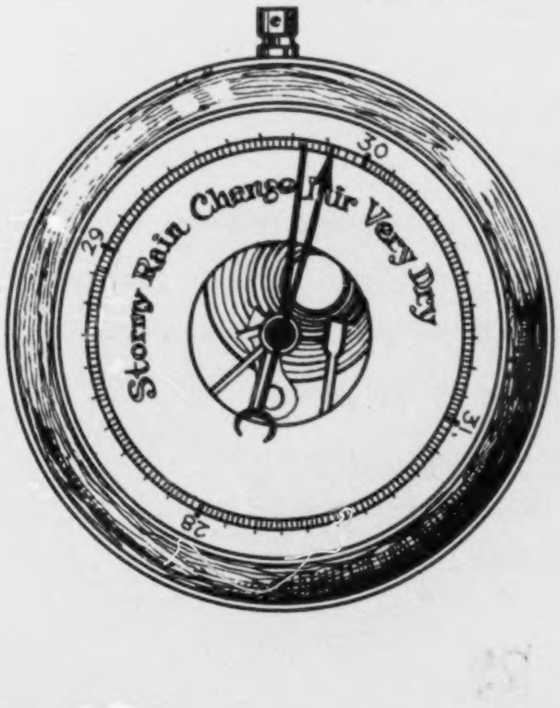
Signs	Description	Miles Per Hour
Smoke rises straight up. Flag wavers slightly.	Calm	Less than 1
Leaves on trees don't rustle. Flag out ¼ from the pole.	Light air	1 — 3 mph.
Leaves rustle. Flag out ½ from the pole.	Light breeze	4 — 7 mph.
Flag now ¾ of way out. Leaves, twigs in motion.	Gentle breeze	8 — 12 mph.
Dust and papers raised. Flag is fully extended.	Moderate breeze	12 — 18 mph.

WEATHER — PART 5: AIR PRESSURE

Air Pressure

The blanket of air above us has weight. This entire weight presses on the surface of the earth due to gravity. The higher we go above sea level, the lighter the pressure. At sea level, we have almost 15 lb. for every square inch pressing against us. This means an average-sized man has a pressure equal to 30,000 pounds all over his body.

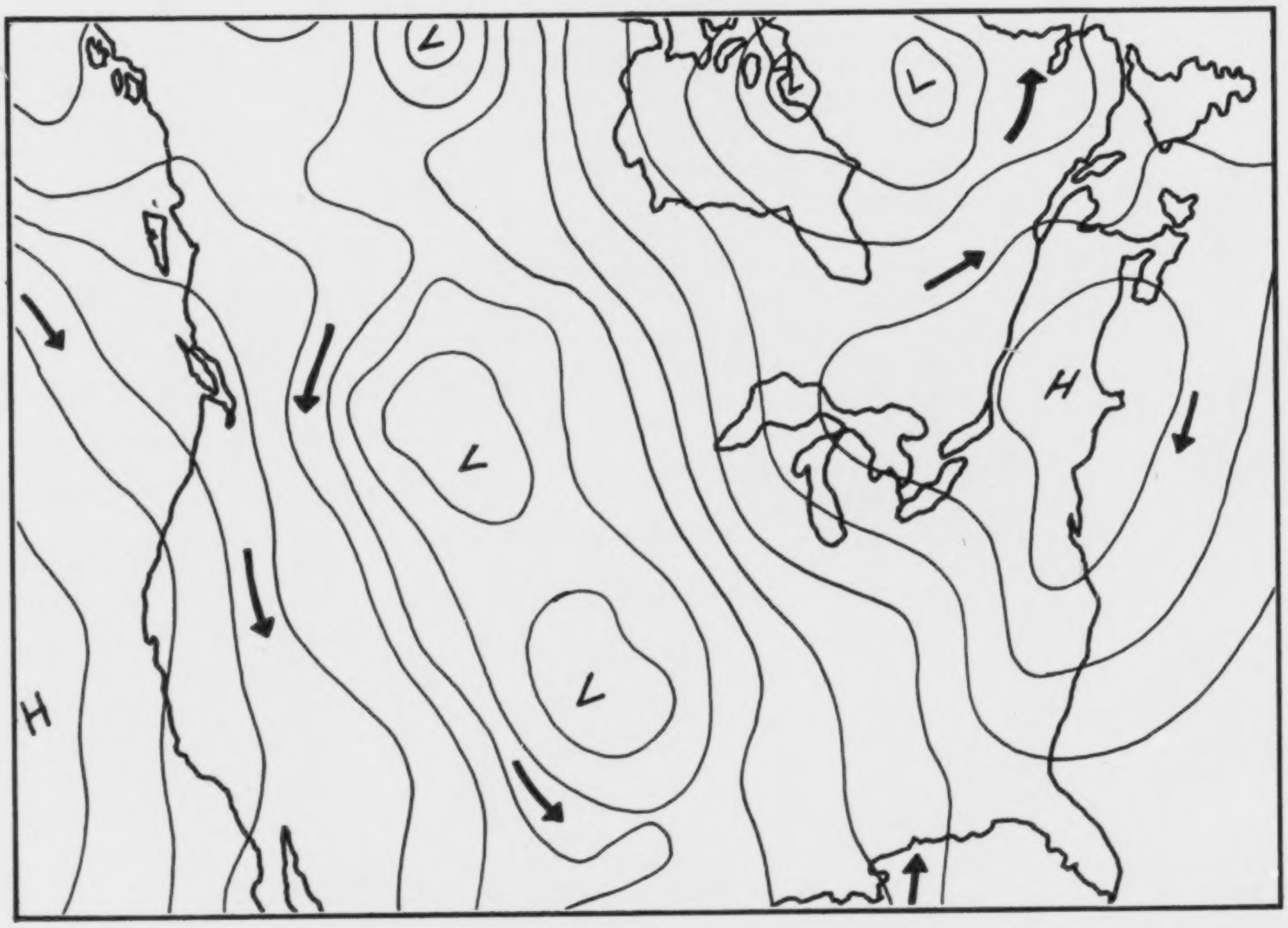
Air pressure affects the winds, temperatures, clouds, and rain, and so is a very important factor in understanding weather.


Stormy Rain Change Fair Very Dry
29
30
31
28

How To Measure Air Pressure

Air pressure is measured with two types of barometers, either aneroid or mercury. *High pressure* usually is found with good, clear, sunny weather; *low pressure* brings in dull, cloudy unsettled weather generally. A *rising* barometer usually means fair weather, while a *falling* barometer is likely to forecast unsettled and cloudy weather.

THE WEATHER MAP



From the words at the bottom of the page fill in the blanks:

1. The lines on the weather map above are called ______________ lines.
2. They join up places of ______________ pressure.
3. Lines joining up places above 29.5 inches barometric pressure join up areas identified as ______________ pressure areas; while lines joining up places below this 29.5 inches are identified as ______________ pressure areas.
4. In a high pressure area the winds flow ______________ while in a low pressure area the winds flow ______________
5. Winds flow from high to ______________ pressure areas.
6. These pressure areas travel from ____________ to ____________ across
7. Canada. (We keep our eye on the west of us to read the map.)

   Lines joining areas of equal temperature are known as ______________

WORDS: EQUAL CLOCK-WISE WEST ISOBAR HIGH
LOW EAST ISOTHERMS COUNTER-CLOCK-WISE

(Words may be used more than once.)

WEATHER SIGNS

Look for cloudy unsettled weather when:

— the barometer is dropping.
— the temperature at night is higher than normal.
— the clouds move in different directions at different levels.
— high thin white (cirrus) clouds increase. (A large ring appears around the sun or moon and stays there until the overcast clouds thicken and obscure the sun or moon.)
— summer afternoon clouds darken.

Look for steady precipitation when:

— there have been signs of unsettled weather.
— the wind is south or southeast, the pressure falling.
(Rain or snow within a day if pressure falling slowly; if falling rapidly, rain soon with winds increasing.)
— the wind is southeast to northeast, the pressure falling. (Rain or snow soon.)
— thunderclouds developing against a south or southeast wind.

Look for showers when:

— thunderclouds develop in a westerly wind.
(Cumulus clouds develop rapidly in the spring or summer early afternoon.)

Look for clearing weather when:

— the barometer climbs.
— the wind shifts into the west or northwest.
— the temperature drops.

Look for continued bright weather when:

— you can look directly at the sun when it sets like a ball.
— the barometer is steady or slowly rising.
— cloudiness decreases after 3 p.m. or 4 p.m.
— morning fog breaks within two hours after sunrise.
— there is a light breeze from the west or northwest.
— there is a red sunset.

Look for higher temperatures when:

— the barometer falls. (In summer, a falling barometer may indicate cloudy weather which will be cooler than clear weather.)
— the wind swings away from the north or the west.
— when the morning sky is clear, except when the barometer is high or is rising in wintertime, or if the wind is strong from the north or west.

Look for lower temperatures when:

— the wind swings from the southwest into the west, or from the west into the northwest or north.
— when skies are clearing (although clearing skies in the morning will likely mean warmer weather by afternoon, particularly in the summer).
— in the winter when the barometer rises.
— snowflurries occur with a west or north wind.
— pressure is low and falling rapidly, wind east or northeast and backing slowly into the north.. (The fall in temperature will be gradual.)

FORECASTING TIPS

Wind Direction	Barometric Pressure	General Forecast
SW to NW	30.10 to 30.20 —	Fair, with little temperature change for 1 to 2 days
SW to NW	30.10 to 30.20 — rising rapidly	Fair, with warmer weather and rain within 2 days
SW to NW	30.20 or above — barometer steady	Remaining fair with little temperature change
SW to NW	30.20 or above — falling slowly	Fair and slowly rising temperatures for about 2 days
S to SE	30.10 to 30.20 — falling slowly	Rain within 24 hours
S to SE	30.10 to 30.20 — falling rapidly	Rain within 12 to 24 hours; wind will rise
SE to NE	30.10 to 30.20 — falling slowly	Rain within 12 to 18 hours; wind will rise
SE to NE	30.10 to 30.20 — falling rapidly	Rain within 12 hours; wind will rise
SE to NE	30.00 or below — falling slowly	Rain will continue 1 or more days
SE to NE	30.00 or below — falling rapidly	Rain with high winds in a few hours. Clearing within 36 hours — colder in winter
E to NE	30.10 or above — falling slowly	*Summer* — With light winds rain in 2 to 4 days *Winter* Rain or snow within 24 hours
E to NE	30.10 or above — falling rapidly	*Summer* Probable rain in 12 to 24 hours *Winter* Rain or snow within 12 hours
S to SW	30.00 or below — rising slowly	Clearing within a few hours, then fair for several days
S to E	29.80 or below — falling rapidly	Severe storm within a few hours, then clearing within 24 hours — colder in winter
E to N	29.80 or below — falling rapidly	Severe storm in a few hours. Heavy rains or snowstorm; followed by cold wave in winter
Swinging to W	29.80 or below — rising rapidly	End of storm — clearing and colder

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ISLAND NATURAL SCIENCE SCHOOL</th></tr>
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<tr><td colspan="2">TIME:</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">TEMPERATURE:</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">BAROGRAPH READING:
(note rising/falling)</td><td>above</td><td>below</td><td>above</td><td>below</td><td>above</td><td>below</td><td>above</td><td>below</td></tr>
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<tr><td colspan="2">ACTUAL WEATHER:</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
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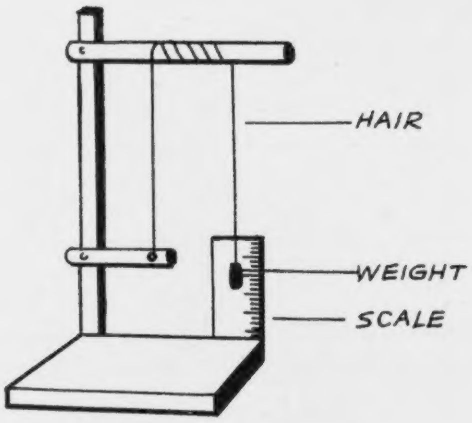
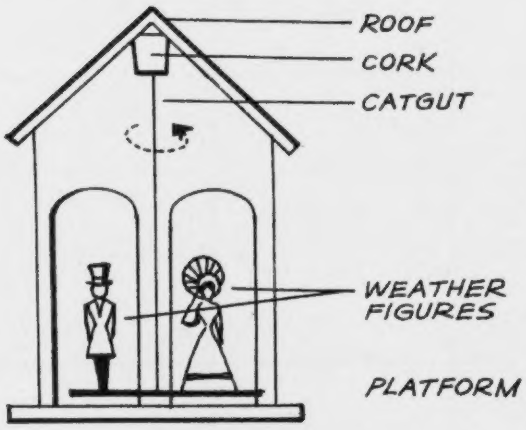
SIMPLE INSTRUMENTS YOU CAN BUILD



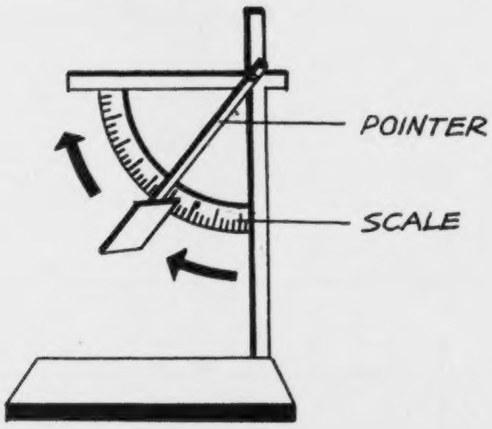
A Simple Hair Hygrometer

Make a hair hygrometer using a clean long hair. Set it up as shown on the diagram. If the weather is dry, the hair will shorten, and raise the weight. If the air becomes humid, the hair will stretch, and the weight will lower.



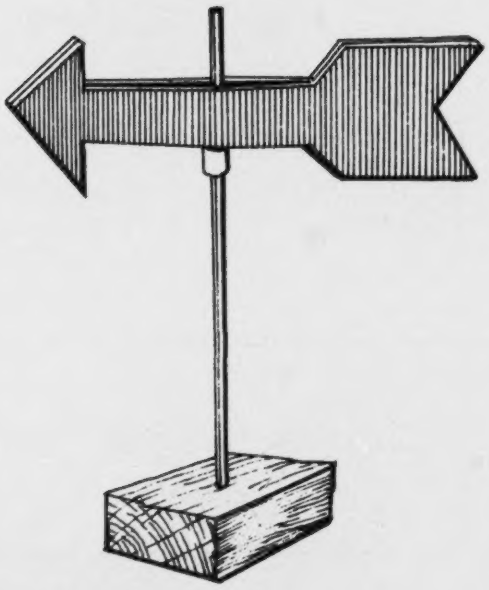
The Weather House

Make a house of cardboard as shown. Glue one end of a piece of catgut, or violin string, to a piece of cork fastened to the roof of house. Connect lower end of catgut to platform with weather figures (one for rainy, one for sunny weather). Catgut will coil or uncoil according to the humidity of the air.



Wind Speed Indicator

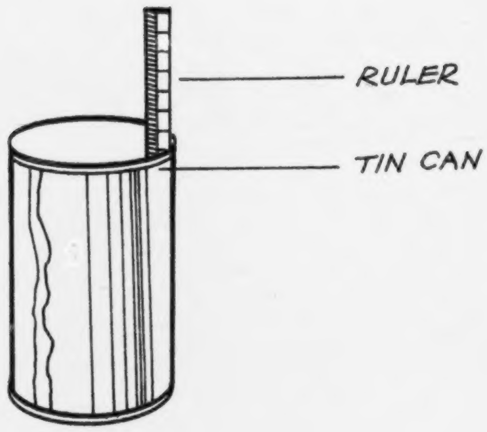
Construct a wind speed indicator as shown. Make sure the pointer is free to swing. The faster the wind blows, the higher the pointer will raise.



Wind Vane

This can be made easily from cardboard or wood. The base is cut out in the shape illustrated and mounted so that it meets the following requirements:

1. It is free to move.
2. It is accessible to the wind.



Rain Gauge

To measure the depth of rainfall use a tall juice tin, and a foot ruler.

LIBRARY BOOKS HAVE LOTS OF GOOD IDEAS FOR OTHER INSTRUMENTS.

FURTHER REFERENCES

1. When in the city call 676-3066 to check your weather reports.

2. Build your own station at school, at home, or at the cottage. For information regarding the construction of simple yet accurate instruments, write to:

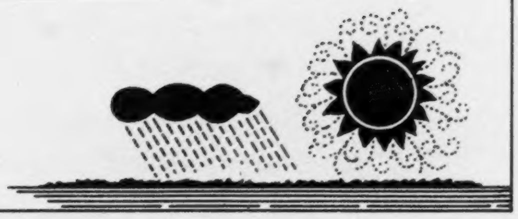
   The Director,
   Dept. of Transport,
   Meteorological Branch,
   315 Bloor Street,
   Toronto, Ontario.

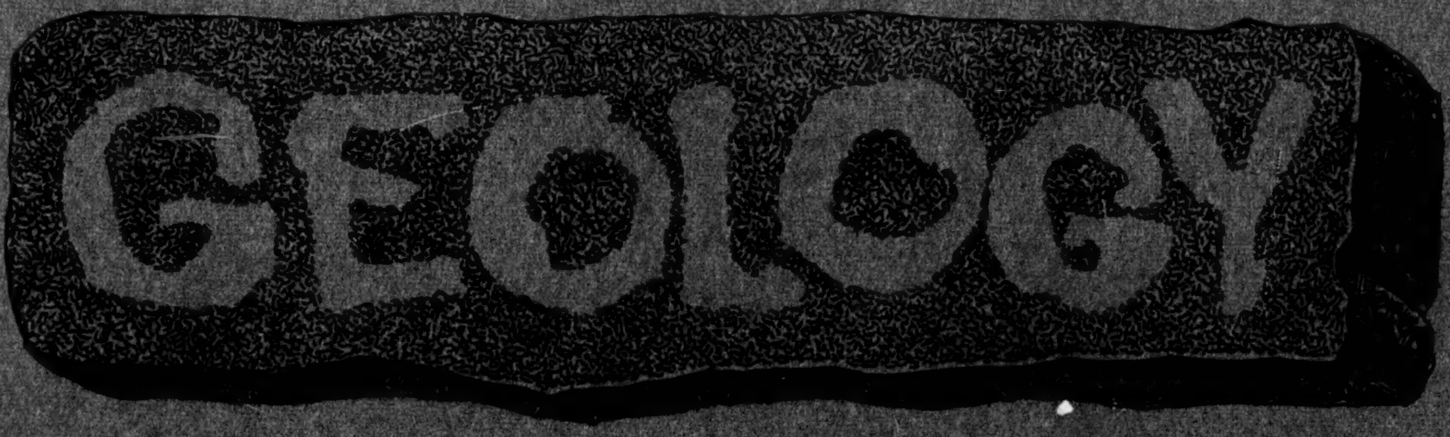
3. Weather maps and cloud charts may also be obtained at the above address.

	Books	Publisher
1.	Everybody's Weather	Lippincott
2.	Weather	Golden Press
3.	Weathercraft	Viking
4.	Hot and Cold	Hale-Cadmus
5.	Exploring the Weather	Doubleday
6.	Science Book of Meteorology	Watts
7.	First Book of Air	Watts
8.	Hurricanes, Tornadoes and Blizzards	E. M. Hale & Co.
9.	Everyday Weather and How it Works	McGraw-Hill
10.	Life Science Library — Weather	

An Island Adventure

(A story in which weather plays an important part.)




GEOLOGY

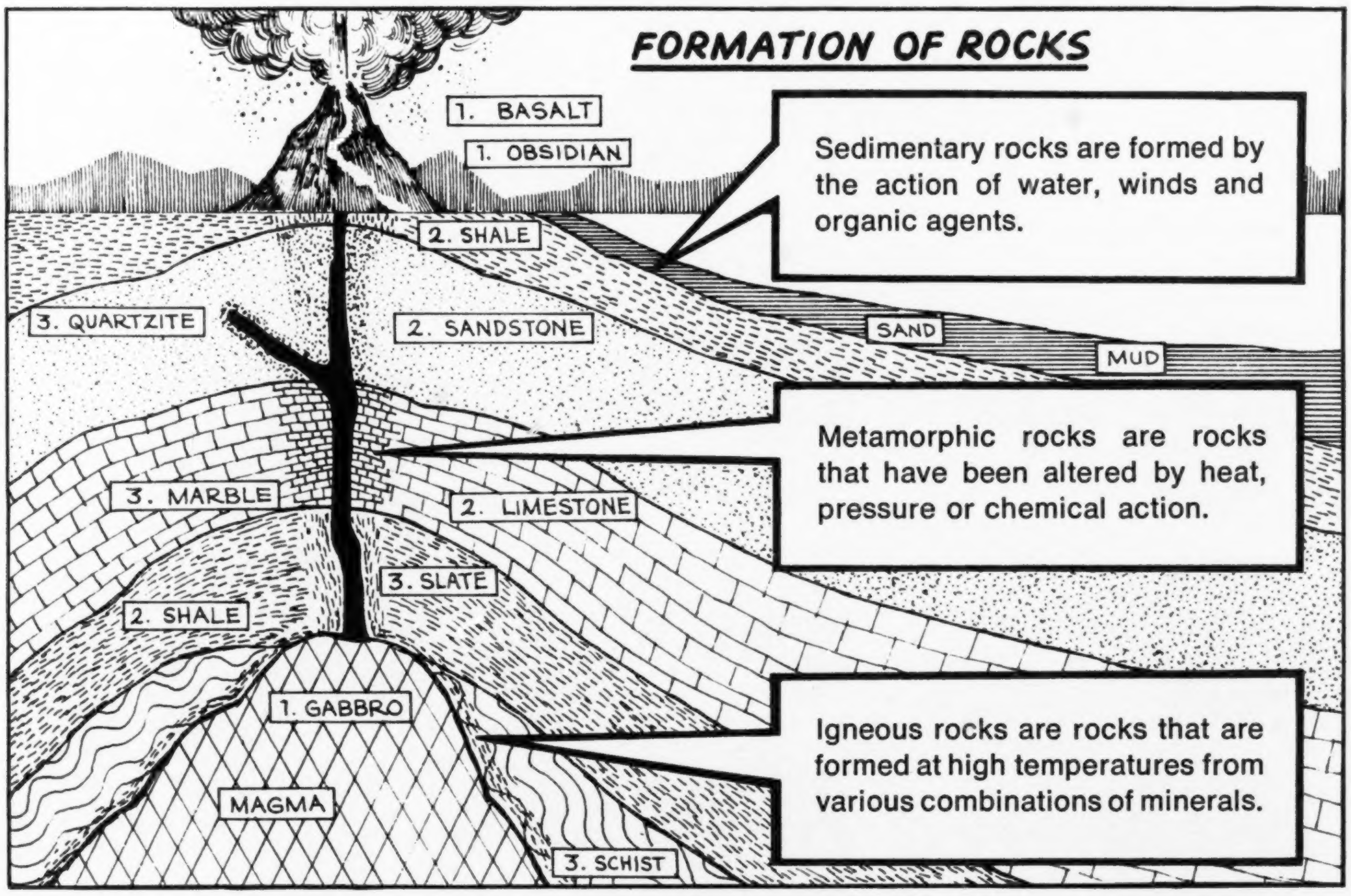
GEOLOGY

Geology, as defined by Webster's Unabridged Dictionary, states that, "Geology utilizes the principles of physics, astronomy, chemistry, mineralogy, zoology, bontany, etc." We can then state, that in its widest sense, geology is the study of man's development and progress through the years.

No man was present at the formation of the earth; hence a number of reasonable ideas or theories have been set forth concerning the earth's origin. The following theory is based on careful study of the earth's most ancient rocks, on evidence written on the face of the moon, and on hints contained in the story of the sun and stars.

Three or four billion years ago, the new earth, freshly torn from the sun, was a ball of whirling gases, intensely hot. Gradually the gases cooled, liquified, and the Earth became a molten mass. The heaviest materials went to the centre with the less heavy ones surrounding them, and the least heavy forming the outer rim. Even today the centre of the earth is a ball of molten iron, very nearly as hot as it was three billion years ago. Around it is a middle layer, not fully hardened, known as basalt. Beyond that is a hard outer shell, relatively thin and made up of a solid basalt and granite.

During this time it is believed that the moon was formed. Perhaps a large tidal wave of earthly material was torn off into space and the moon was born.



Sedimentary rocks are formed by the action of water, winds and organic agents.

Metamorphic rocks are rocks that have been altered by heat, pressure or chemical action.

Igneous rocks are rocks that are formed at high temperatures from various combinations of minerals.

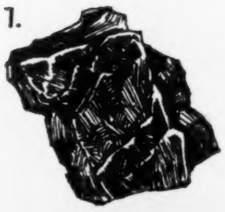
What is a rock? What is a mineral? Perhaps you have asked yourself these questions at one time or another. In simplest form, minerals are elements in chemical combinations. Rocks are large masses made up of minerals. Minerals came together to form rocks much like the flour, sugar, apples, etc. come together to make your mother's apple pie. Sometimes a rock may be made up of a number of minerals; sometimes it is just one.

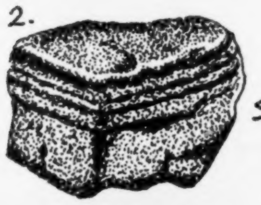
Let us look at some of the different types of rock. Three Basic Classifications of Rock:

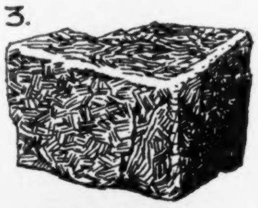
Igneous — This is "fire-formed" rock. It is the rock from which all others come. Igneous rock is lava and magma that has cooled and become solid. Some examples of this type are: granite, diorite, gabbro, basalt, obsidian and pumice.

Sedimentary: These are rocks that may come from igneous rock or metamorphic rock or even from other types of sedimentary rock. The constant "weathering" by wind, rain, sleet, wave action, etc., caused the rocks to break down into small particles. These particles were then carried to lakes and oceans where they filtered down to the bottom. Under the pressure of the water and their own mass they were pressed into rock. Common examples are shale, sandstone, limestone, conglomerate and breccia.

Metamorphic: These are rocks that have been changed from igneous, sedimentary or other, older metamorphic rocks. This change may be caused by earthquakes, glacial action causing pressure and heat or perhaps by chemical action.
Metamorphosed shale becomes slate.
Metamorphosed granite becomes gneiss.
Metamorphosed limestone becomes granite.
Metamorphosed sandstone becomes quartzite.
These are a few of the changes or metamorphosis that some rocks undergo.

1.

BASALT

2.

SANDSTONE

3.

QUARTZITE

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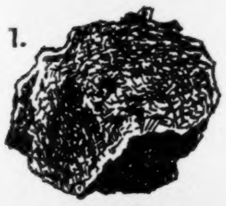
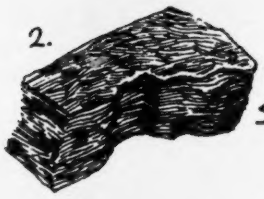
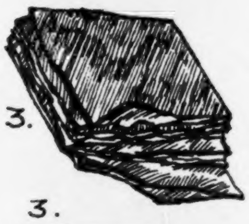
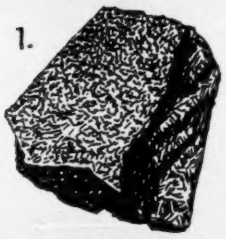

GABBRO

2.

SHALE

3.

SLATE

1.

GRANITE

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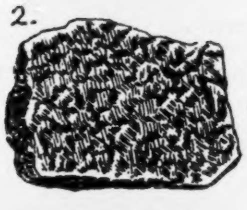
LIMESTONE

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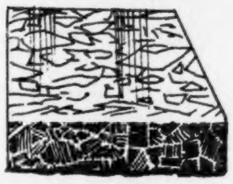
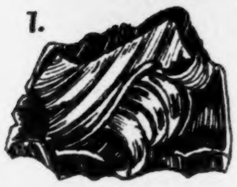
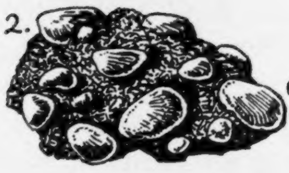
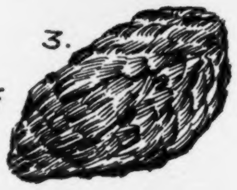

MARBLE

1.

OBSIDIAN

2.

CONGLOMERATE

3.

SCHIST

Mineral Identification: It is often quite difficult to identify a mineral simply by its appearance. Often we must use one or a number of tests to find a mineral's identity.

a. One of these ways is by testing a mineral's hardness. We do this by scratching the unknown mineral with a mineral of known hardness; we use the hardness scale which consists of ten minerals, all of varying hardness. 1) Talc, 2) Gypsum, 3) Calcite, 4) Fluorite, 5) Apatite, 6) Orthoclase, 7) Quartz, 8) Topaz, 9) Corundum, 10) Diamond. If you have an unknown mineral which you are testing for hardness and it scratches quartz and not topaz, it has a hardness of between 7 and 8. Two minerals that scratch each other are of the same number or hardness.

b. *Specific Gravity* — This refers to the weight of the material compared to the weight of an equal volume of water. If a mineral weighs 10 pounds and displaces 5 pounds of water we say it has a specific gravity of 2.

c. *Cleavage* — This is the way a mineral splits or comes apart. Some minerals split smoothly. This is known as good cleavage. E.g., Mica has one cleavage plane. Other minerals may split in more than one direction, e.g., Calcite splits in 3 directions.

d. *Fracture* — This occurs when the mineral breaks on a line that is not parallel to the cleavage plane. E.g., It may be rough or splintery.

e. *Streak* — This is the powder left when a mineral is rubbed against white unglazed porcelain, e.g., back of bathroom tile. Most streaks are white but some are coloured such as pyrite, a yellow mineral, which leaves a black mark.

Colour, Lustre and Transparency

Colour, of course, refers to the colour of the mineral. Lustre refers to the way light is reflected from the mineral's surface. E.g., glassy, as in quartz or pearly as in talc. Transparency refers to the amount of light a mineral will let pass through it. A mineral is opaque if no light passes through it.

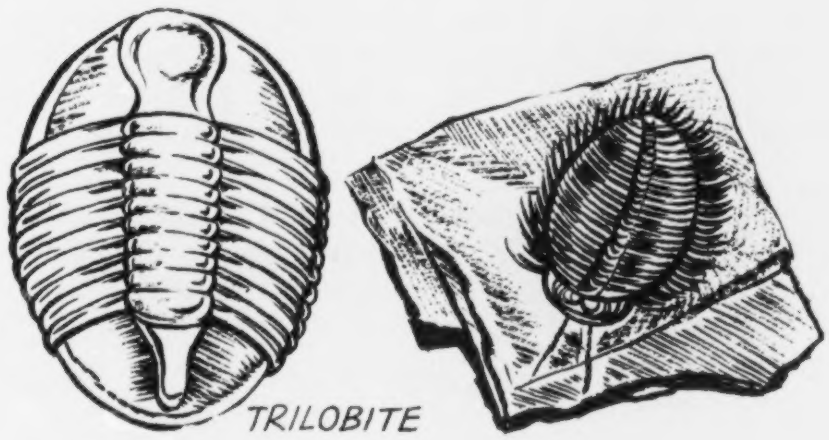
You can readily see that there is a great deal to learn about geology. If you are interested in broadening your knowledge on this topic, these are some excellent reference books:

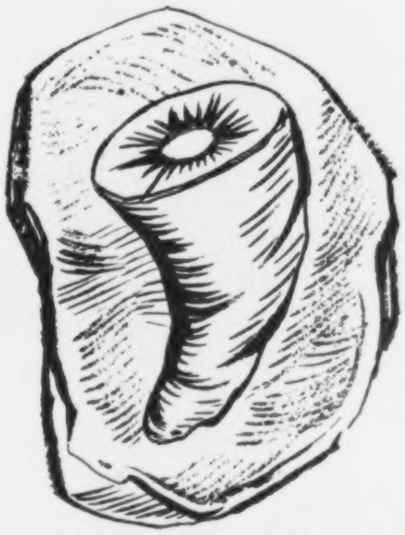
1. My Hobby is Collecting Rocks and Minerals — Children's Press.
2. The Story of Geology — Golden Press.
3. Starting a Rock and Mineral Collection — C. S. Hammond & Co.
4. Rocks and Minerals — Golden Press.
5. Rocks, Rivers and the Changing Earth — William R. Scott, Inc.
6. The Story of Rocks and Minerals — Harvey House.

Fossils

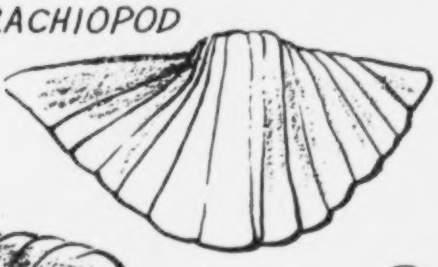
Fossils are very interesting because they tell of an age long past. They are the remains of plants and animals that existed when the rock was forming. Because of this they are of great historical interest to us.

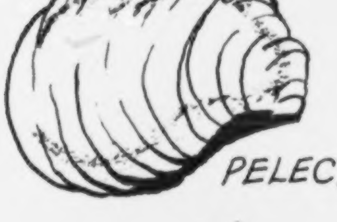
Some fossils are present in the different types of shales here on the Island. See if you can find some and identify them by using the chart on the next page.

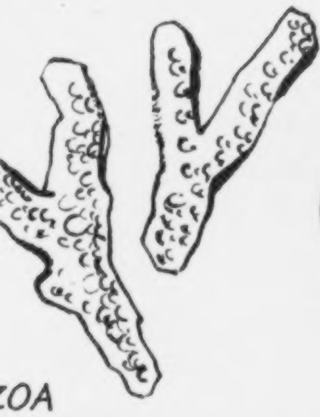

TRILOBITE

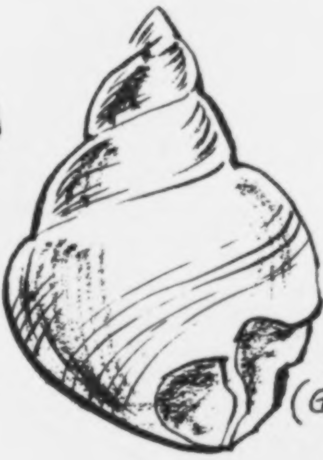

SOLITARY HORN CORAL

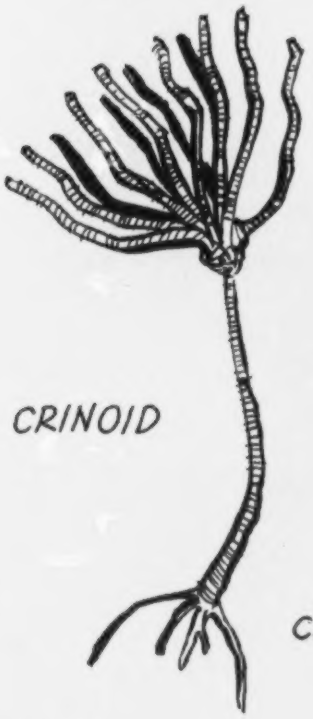
BRACHIOPOD

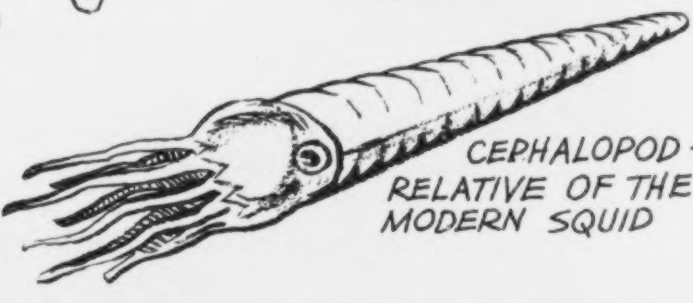


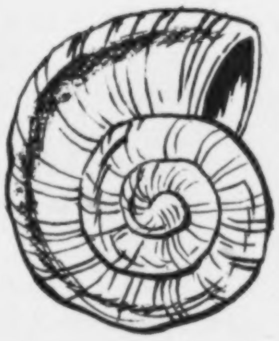

PELECYPOD

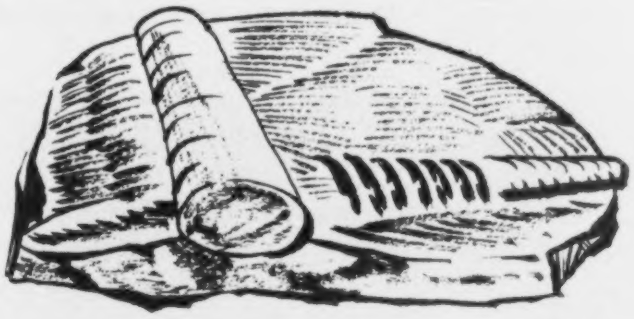

BRYOZOA


SNAIL (GASTROPOD)

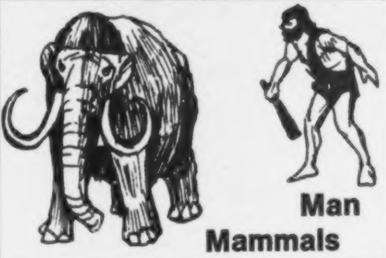
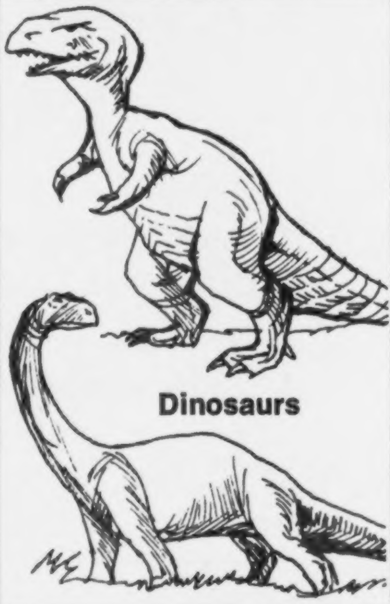
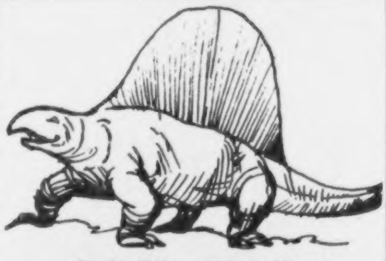
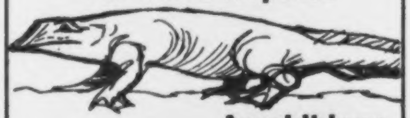
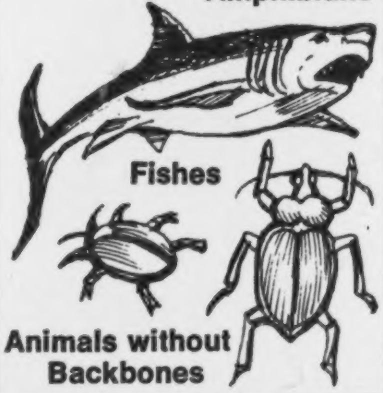
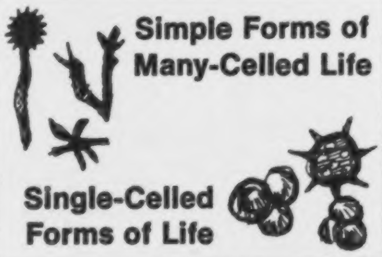

CRINOID


CEPHALOPOD – RELATIVE OF THE MODERN SQUID


AMMONITE – A COILED CEPHALOPOD


CEPHALOPOD FOSSILS

GEOLOGIC TIME CHART

Eras		Ages	Number of Years Lasted	Important Forms of Animal Life
CENOZOIC (see-nuh-ZO-ick) (began about 70 million years ago)		**Age of Man**	1 million years	 Man Mammals
		Age of Mammals	60 million years	
MESOZOIC (mess-uh-ZO-ick) (began about 190 million years ago)	**PERIODS** Cretaceous (kree-TAY-shuss)	**Age of Dinosaurs**	50 million years	
	Jurassic (joo-RASS-ick)		35 million years	
	Triassic (try-ASS-ick)		35 million years	
PALEOZOIC (PAY-lee-uh-ZO-ick) (began about 540 million years ago)	Permian (PURR-mih-yunn) Pennsylvanian Mississippian	**Age of Amphibians**	350 million years	 Primitive Reptiles
	Devonian (deh-VOH-nih-yunn) Silurian (sih-LURE-ih-yunn)	**Age of Fishes**		 Amphibians
	Ordovician (or-doe-VISH-yunn) Cambrian (KAMM-brih-yunn)	**Age of Animals without Backbones**		 Fishes Animals without Backbones
PROTEROZOIC (PROTT-urr-uh-ZO-ick)		**Simple Forms of Many-Celled Life**	1500 million years	 Simple Forms of Many-Celled Life Single-Celled Forms of Life
ARCHEOZOIC (ARK-ee-uh-ZO-ick)		**Single-Celled Forms of Life**		

FOSSILS AND FOSSIL HUNTING

1. What is a fossil?

2. Why are fossils on the island so important?

3. What is the age of the fossils you found?

4. Briefly tell how a fossil is formed.

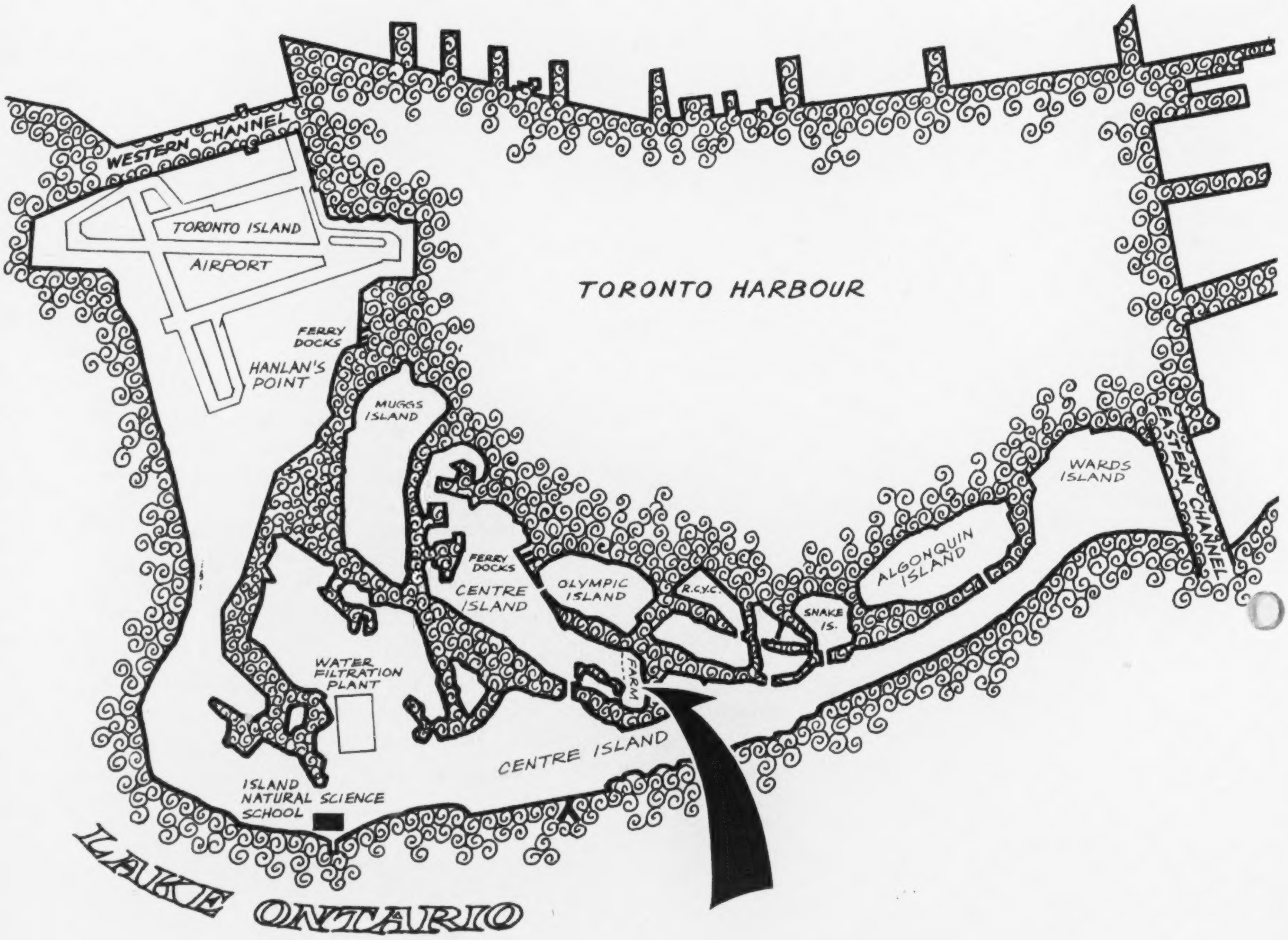
5. Draw some of the fossils you found.

FARM

"FAR ENOUGH" FARM

In the past, man had to go out hunting for his food. He had to trail, stalk, shoot and cut down any meat or plants that he could find. This required nearly all of his time. Later he developed grazing pastures close to home where herds of game collected and made his job a little easier. Man discovered that certain plants could be cultivated. This led to the regular farming of crops and a more certain supply of food. As time went on more and more animals became domesticated. Then they were developed along more special lines to provide food, clothing products and other assorted goods.

At the farm on the Island you see a cross-section of man's domesticated animals. However, most farms today are specialized to provide more efficient service to large populations. Most farms are especially geared to dairy or meat products or strictly crops.


WESTERN CHANNEL
TORONTO ISLAND
AIRPORT
TORONTO HARBOUR
FERRY DOCKS
HANLAN'S POINT
MUGGS ISLAND
FERRY DOCKS
CENTRE ISLAND
OLYMPIC ISLAND
R.C.Y.C.
SNAKE IS.
ALGONQUIN ISLAND
WARDS ISLAND
EASTERN CHANNEL
FARM
WATER FILTRATION PLANT
CENTRE ISLAND
ISLAND NATURAL SCIENCE SCHOOL
LAKE ONTARIO

ANIMALS	DESCRIPTION	USES

ANIMALS	DESCRIPTION	USES

OUTDOOR PURSUITS

OUTDOOR PURSUITS

While you are at the Island School we will try to show you as much as we possibly can about the out-of-doors. We hope to show the basic relationship that exists between plants and animals and between living and non-living members of the environment. These "mechanics" are the basis to an understanding of the environmental way of living. As well as teaching the mechanics we will also endeavor to show how the out-of-doors may be used for pleasure and relaxation.

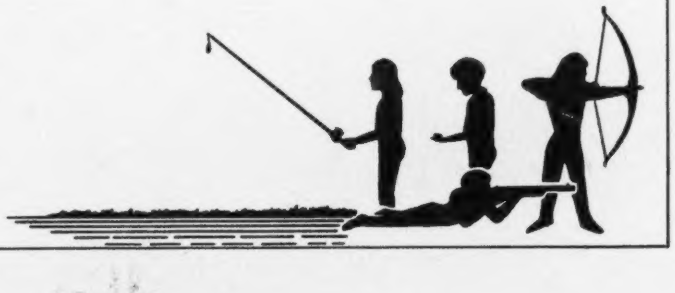
By the time you leave school to get a job, the working week will probably be 35 hours or less. Holidays will be longer. Some are even predicting that in the future the majority of people will not have to work at all. Leisure will not be a sought-after pleasure but will probably become a problem. "What can we do with our time?" will become a big question.

If we connect this coming problem of leisure time with the present problem of decreasing environmental quality, we can immediately see the need for educating people in using the out-of-doors wisely. During your stay at the Island School we hope to show you some forms of recreation that are unique to the outdoor setting. Time will not permit teaching all sports that lend themselves to the natural environment, but a basic introduction to a few may influence your choice of future interests and hobbies. During your stay we will try and introduce angling or bait casting, target shooting or marksmanship, archery and orienteering.

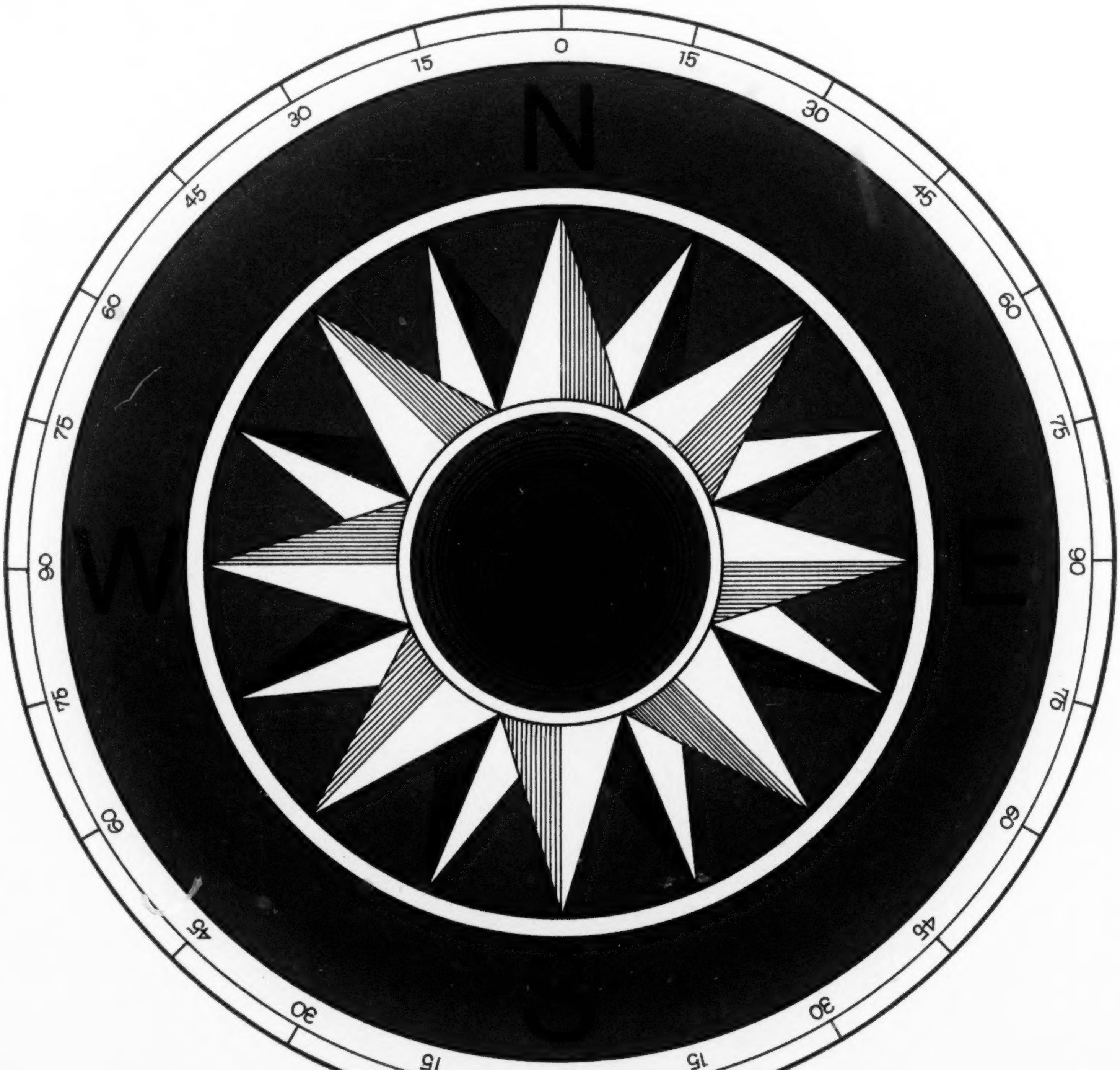
You will have a chance to partake in some or perhaps all of these, depending on the weather and time of year. We will also attempt to show how some of the "mechanic" subjects can have interesting, life-long hobbies associated with them. For instance the collection and polishing of stones (the rock hound can easily develop from the lesson in geology), the observing of birds, hiking, over-night camping and astronomy, are a few of the outdoor pursuits you may wish to continue long after your week with us.

We hope some foggy morning in the future, as you are sitting quietly fishing and enjoying a feeling of peace and quiet, you will not only think of this week, but also see the need of passing these basic skills on to future generations.

My Story of Outdoors at the Island.



ORIENTEERING


0
15
15
30
30
45
45
60
60
75
75
90
90
N
W
E

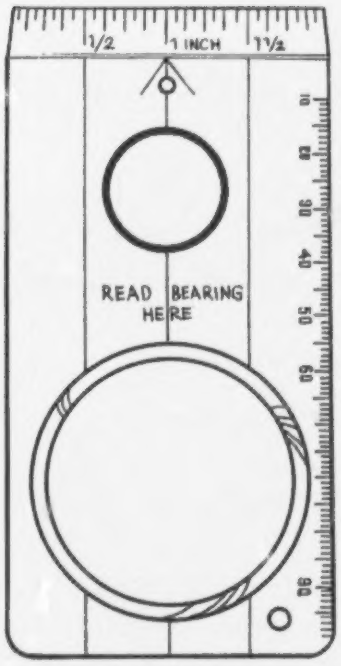
THE COMPASS

The Compass is a basic instrument from which all other direction finders have been developed. In the past, man used objects in the sky to assist him in travelling great distances over unfamiliar territory. This method was unsatisfactory because these objects were forever moving and also because of frequent cloud cover.

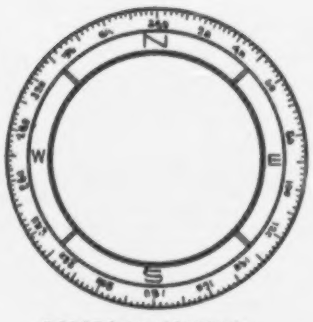
Nature, however, has provided man with the means to find any direction he wants, at all times and under all weather conditions — the *Magnetic Compass*. Such compasses were used in Europe as early as the twelfth century and later by such explorers as Magellan and Columbus.

What is a Magnetic Compass and how does it work? It is simply a magnetized needle on a pivot which always seeks out the Magnetic North Pole. Why? Because the earth itself acts like a huge magnet. Lines of force (running north-south) connect the magnetic poles and the magnetized needle simply lines itself up with them.

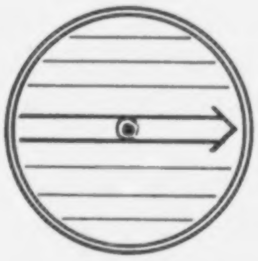
Today's advanced means of transport (e.g., jumbo jets, supersonic aircraft, ocean liners, nuclear submarines and indeed space-craft) use very complicated and expensive navigational equipment, whose basic principles were developed from the simple compass we all know. Basically, the compass and its modern counterparts are instruments which will indicate one known direction.



BASE PLATE



COMPASS HOUSING

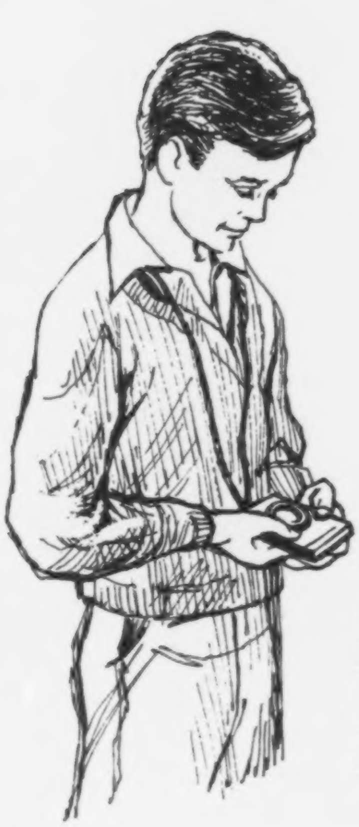


BOTTOM

Some Compass Terms

1. Needle — red end always points out Magnetic North when the compass is held flat; do not confuse with the "Read Bearing Here" arrow.
2. Housing — circular, metal dial with numbers and letters; the needle's house.
3. Base or base plate — the flat bottom part.
4. 'Read bearing here' arrow — middle of base — the one to follow.

NEEDLE
RED END NORTH



How to set a liquid-filled Silva Compass

1. Hold compass level.
2. Point 'Read Bearing Here' arrow straight ahead of you.
3. Turn housing until the desired number of degrees (Azimuth Reading) is set at the 'Read Bearing Here' arrow.
4. Slowly and carefully rotate your body until the red end of the needle is pointing to the letter N and is steady over the ORIENTEERING arrow outlined on the base.
5. Hold still and pick a non-moving object at which the 'read bearing here' arrow is pointing and walk to it.

There are 32 named points on a compass card, although few people can name them. Perhaps you'll soon be one of the few people who can. The most important points (the CARDINAL POINTS) are North, South, East and West. The remaining 28 named points take their names from various combinations of North, South, East and West. On the compass the Cardinals are marked, N., S., E., W.

Can you find them on the compass?

What directions do you think are represented by the small lines halfway between them?

Every circle has 360 degrees and, as the housing or compass card is circular, it too must have 360 degrees. When we "set" and "read" a compass we usually do so in degrees.

1. If you were facing north and were asked to take a 180° reading, what direction would you then be facing?
2. Still facing north, name the directions you would be facing after taking a reading of a) 270° b) 45° c)225° and d) 135°.

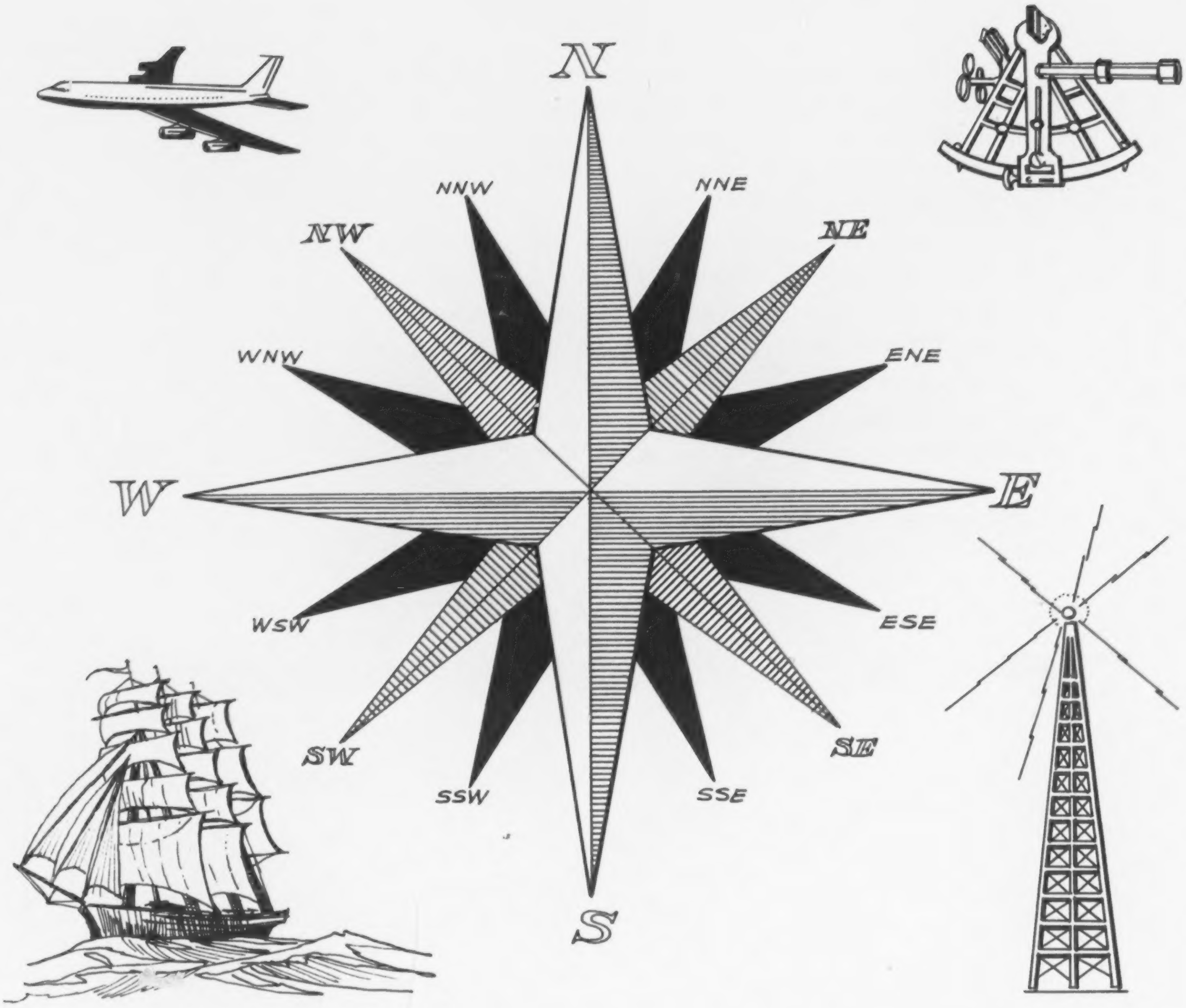
To make your own simple Magnetic Compass

1. Place a needle on a magnet for two or more days.
2. Tie the needle to a thread.
3. Hang thread to the ceiling.

Test Yourself

1. How many men could you name whose lives depend on the careful use of a compass?
2. What other navigational aids do you know?
3. Why is water an unsatisfactory liquid to use in a liquid-filled compass?
4. On a ship, does the rolling or pitching movement affect the usefulness of a compass? If not, why not?
5. How could some minerals affect the magnetic compass?
6. In what part of the world would a magnetic compass be useless?
7. The angle between True North and Magnetic North is called VARIATION. Do you think this angle would be the same everywhere in the world? Why?
8. In navigational terms, opposite directions are called RECIPROCAL BEARINGS. For example, the reciprocal bearing of East is West. How many degress must you always add OR subtract to find a reciprocal bearing?

POINTS OF THE COMPASS


N
NNW
NNE
NW
NE
WNW
ENE
W
E
WSW
ESE
SW
SE
SSW
SSE
S

Set your compass at the following readings and record their approximate directions:

1. 310° ____________________

2. 201° ____________________

3. 348° ____________________

4. 50° ____________________

5. 111° ____________________

6. 9° ____________________

7. 97° ____________________

8. 249° ____________________

9. 186° ____________________

10. 125° ____________________

A Game To Play By Yourself

1. Take a reasonably small object (not valuable as you may not be that good) and set it down in an open space. Stand right over it.
2. Set your compass at X degrees (X being any number you choose between 0 and 100). Take a reading; pick an object in line with your 'Read Bearing Here' arrow and take Y number of paces towards it. (Y being any number you choose — keep it reasonable, e.g., 40 feet).
3. Add 120 degrees to your original setting (X + 120) and proceed as in 2. (N.B. still measure Y paces).
4. Add another 120 degrees to your last setting (X + 120 + 120) and proceed as above.

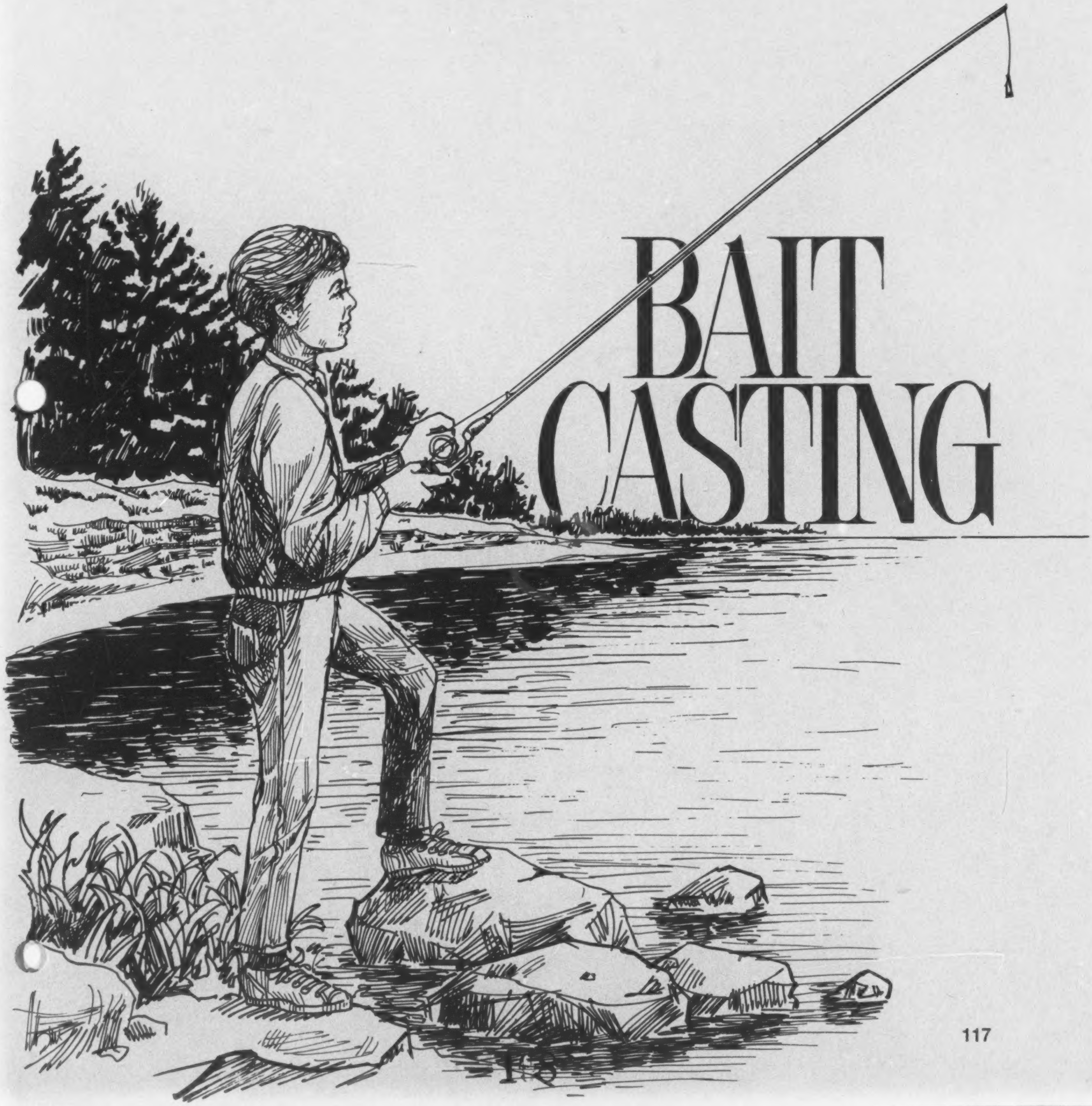
Where are you now?
(Score one mark off 100 for each foot you are short of your object.)
In what geometric shape did you walk?
Perhaps you can figure out mathematically how this game works.

A GAME TO PLAY WITH A PARTNER

1. Write your name on a small piece of paper and exchange it for your partner's name.
2. Starting from an established point, use your compass to find 3 or more directions (depending on how good you are) and measure off certain numbers of paces or feet in these directions. These may be varying distances.
3. Place your partner's name on the spot where you finish. Give him your recorded information* (headings and distances) and see if he can find his name. On a windy or wet day use a small, worthless object which will not blow or wash away, e.g., a button. Score as before: total mark 100; lose one point for each foot in error.
For example — 9 feet off object 100 — 9 = 91.

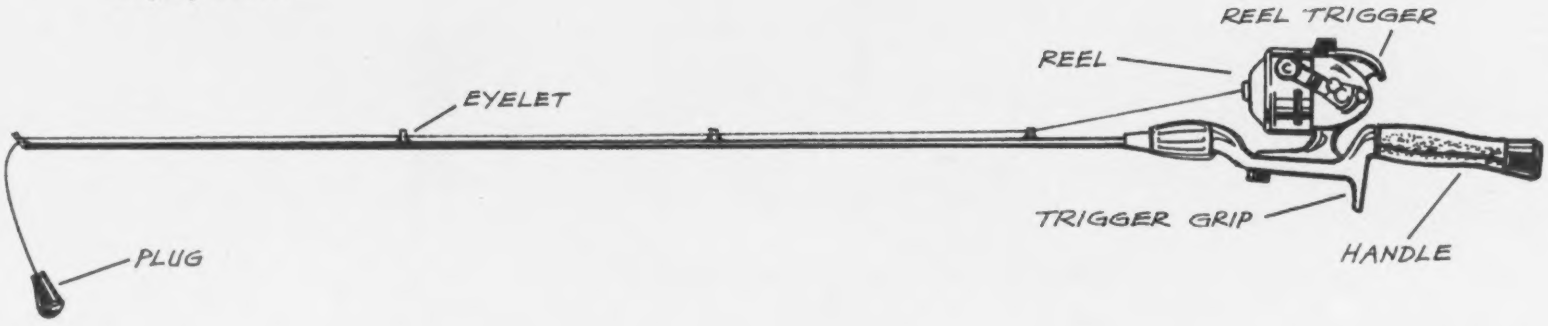
* a. 200 degrees for 35 feet
b. 17 degrees for 39 feet
c. 311 degrees for 48 feet
d. 188 degrees for 50 feet
e. 233 degrees for 13 feet

BAIT CASTING



BAIT-CASTING

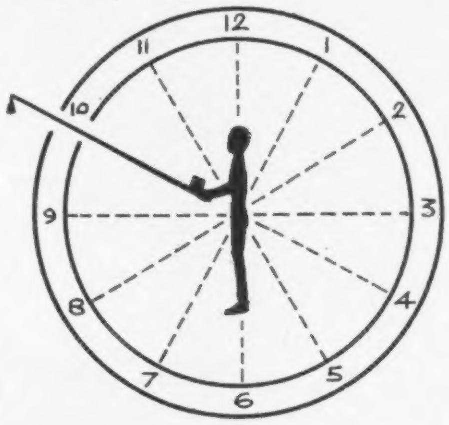
Equipment


REEL TRIGGER
REEL
EYELET
TRIGGER GRIP
HANDLE
PLUG

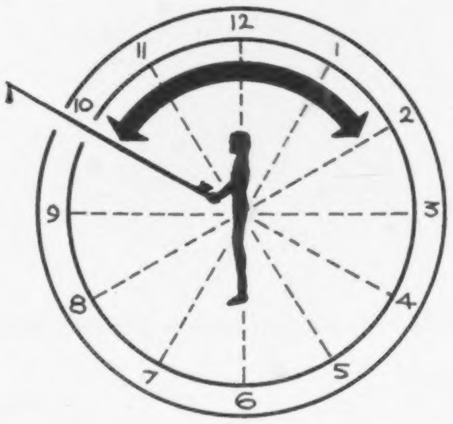
Method

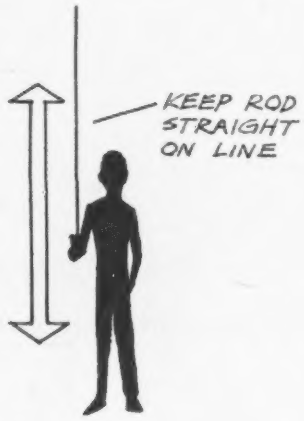
a. Preparation

1. Grasp the handle with the last three fingers and place index finger on the trigger grip. The thumb is placed on the trigger of the reel.
2. Turn the rod and reel so that the reel is on the side of the rod closest to the body.
3. Hold the rod directly in front of the body, as shown in the diagram below.



4. Using only your wrist and forearm move the rod in a smooth sweep from ten o'clock to two o'clock and back again.





Practise this action till it is smooth and easy.

b. Casting

1. Press thumb down on the reel trigger on the back swing.
2. At the beginning of the forward swing release the thumb and the line will reel out.

   (If the plug drops to the ground behind you, your thumb was released too soon.

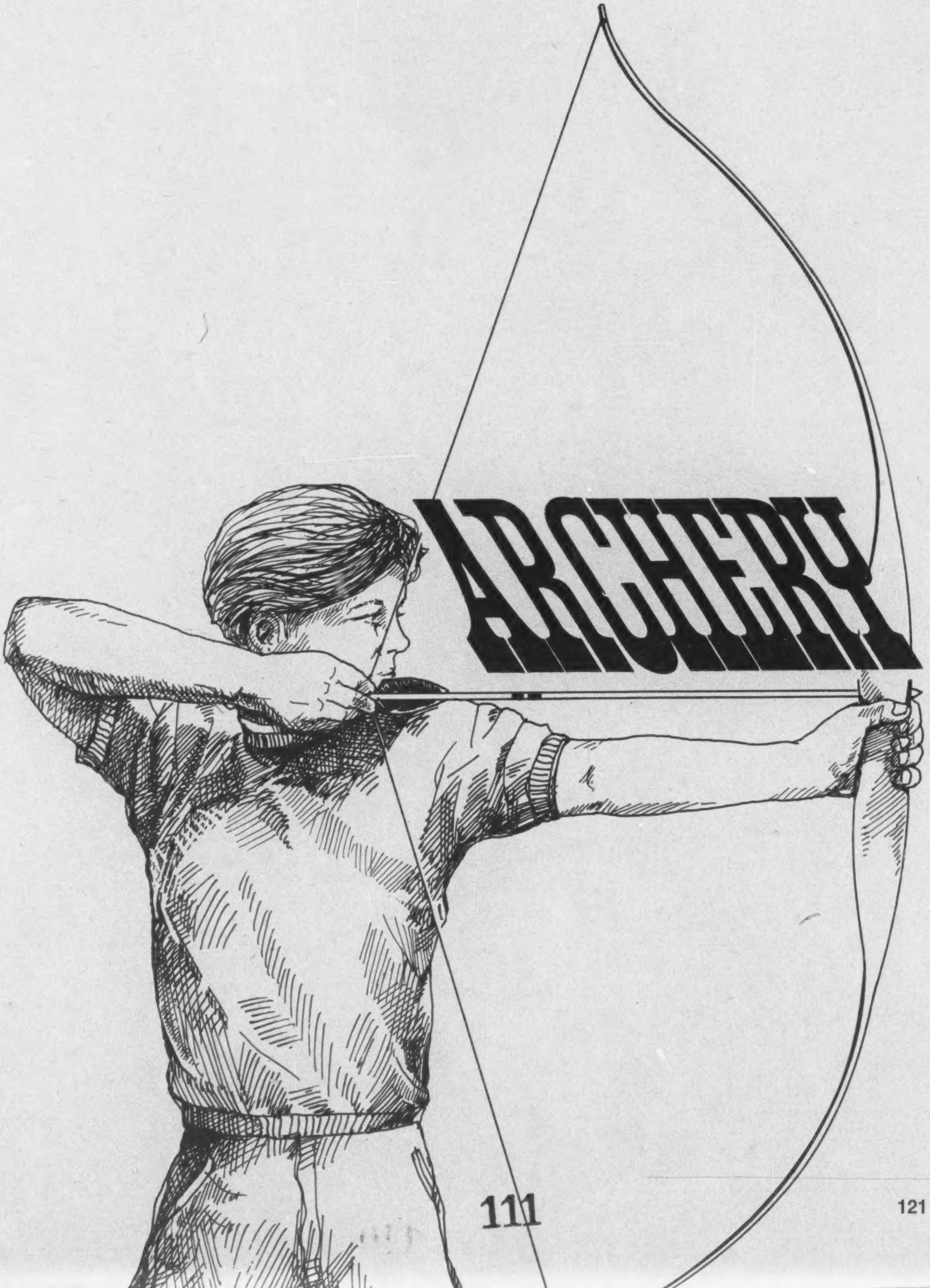
   If the plug is fired into the ground at your feet, your thumb was released too late).

Practice Forms

Using the lid of a garbage can practise casting onto it at distances of up to 15 feet. Once this is mastered move the lid to a greater distance. As proficiency increases change the target for one of smaller size, e.g., a hat.

To increase your ability as a bait caster you must be able to cast from a seated position. This is essential, as much fishing is done from a boat.

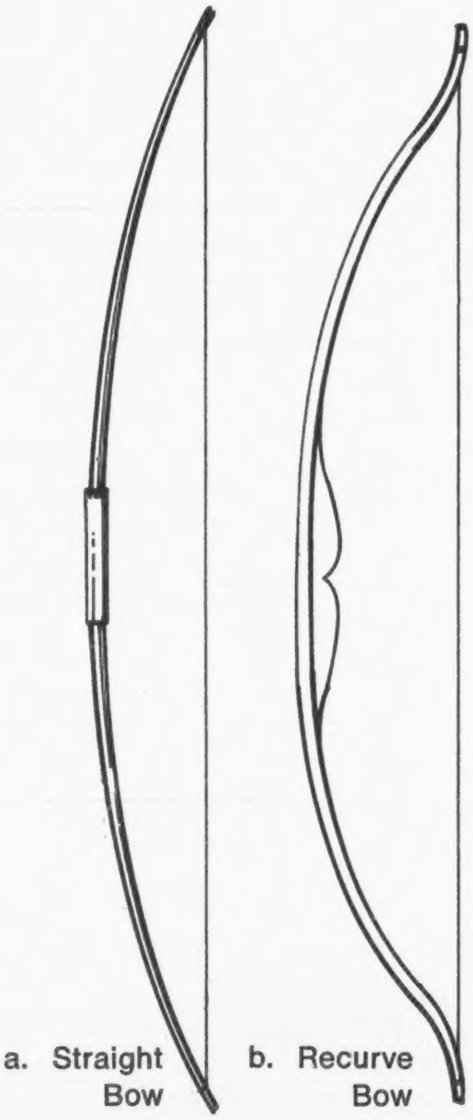
ARCHERY



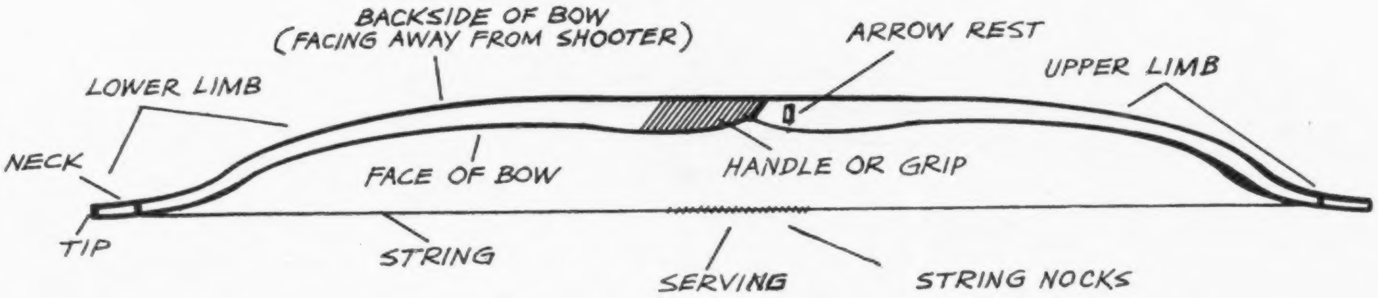
ARCHERY

Archery is another of the life-time sports and it is a most enjoyable one. In order to aid teaching instruction and improve your knowledge of this relaxing and pleasurable sport, a familiarity with the parts of the bow and arrow and the terms used, is required.

There are two basic types of bow: (a) the straight bow; (b) the recurve bow. As the name implies the straight bow is, when unstrung, straight. The recurve bow has limbs which curve opposite to its strung position, when unstrung.

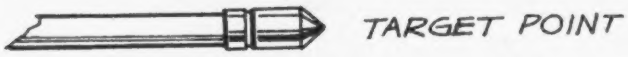


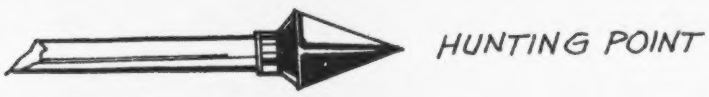
PARTS OF BOW

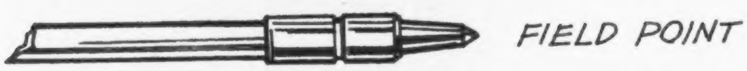

BACKSIDE OF BOW
(FACING AWAY FROM SHOOTER)
ARROW REST
UPPER LIMB
LOWER LIMB
NECK
FACE OF BOW
HANDLE OR GRIP
TIP
STRING
SERVING
STRING NOCKS

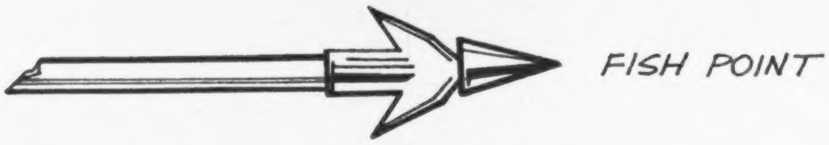
TYPES OF ARROWS

Arrows should be chosen according to the purpose for which they will be used. Below are some of the common arrows:

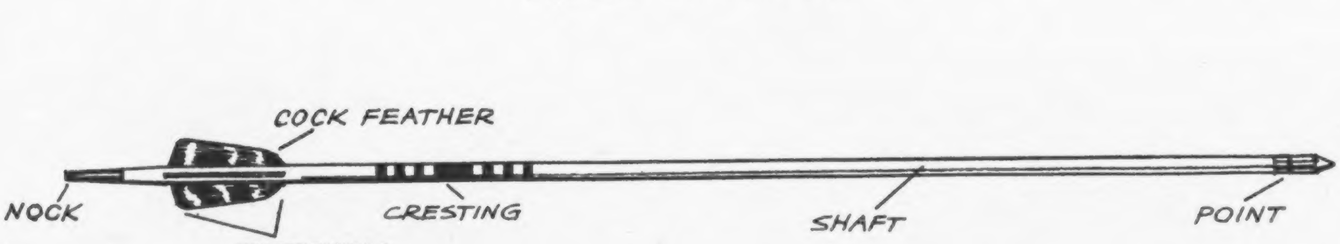

TARGET POINT


HUNTING POINT


FIELD POINT



PARTS OF ARROW


COCK FEATHER
NOCK
CRESTING
SHAFT
POINT
FLETCHING

Helpful Terms in Archery

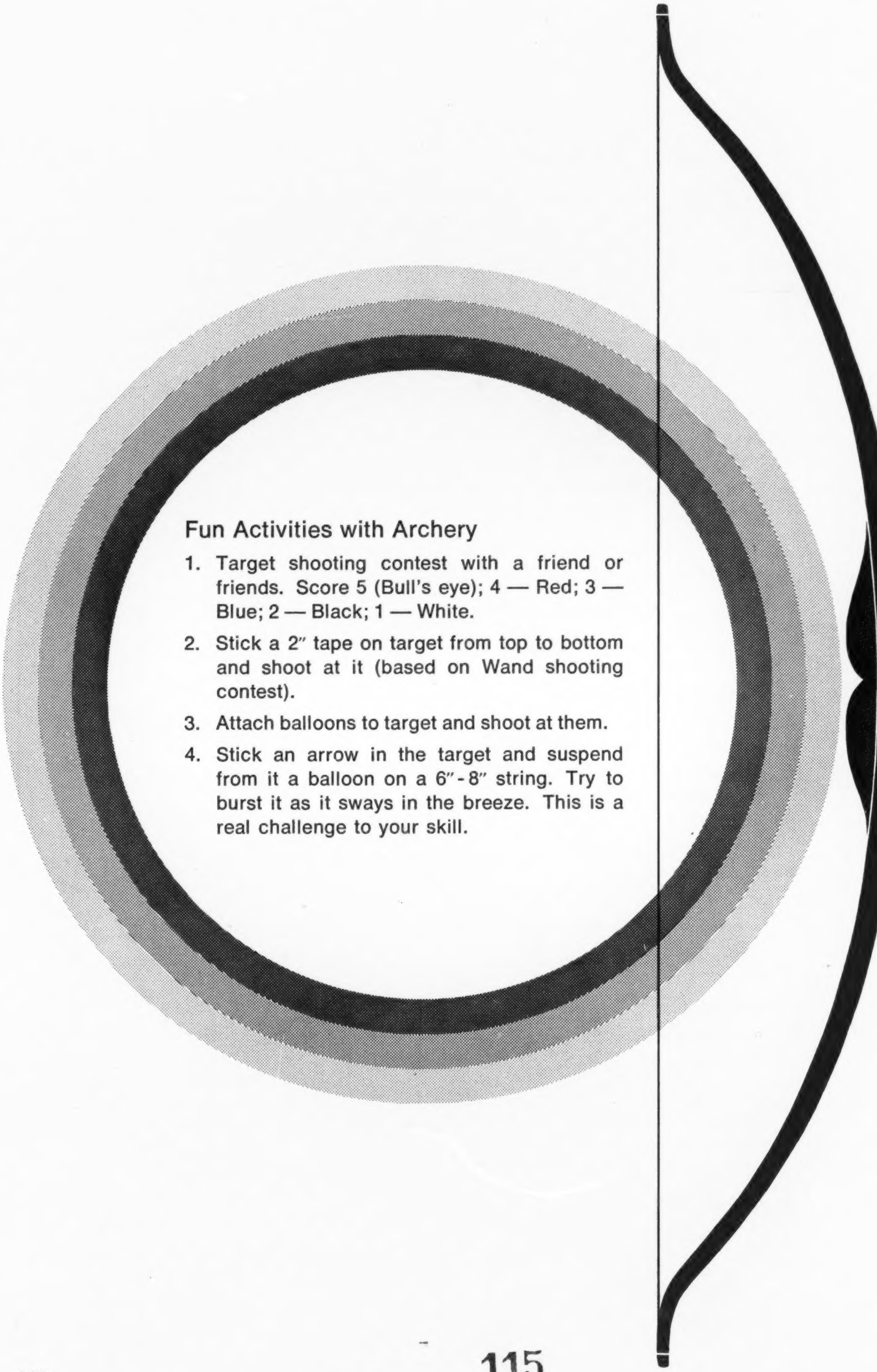
Anchor Point	a certain spot on the shooter's face to which the bow string should always be drawn to give consistency in shooting.
Bow Arm	the arm that holds the bow.
Cock Feather	the odd coloured feather.
Draw	to pull the bow string back to the anchor point.
Drawing Arm	the arm that draws the bow string back.
Hen Feathers	the two feathers of the same colour.
Nock	the groove in the end of the arrow into which the bow string fits.
Quiver	something to hold the arrows.
Stance	position taken up in shooting an arrow.
Weight	the amount of effort required to pull the bow.

Safety at the Butts

1. A 'loaded bow' can kill — it is a very dangerous weapon.
2. Never shoot at anything other than a target.
3. Never allow anyone to hold a target for you.
4. Don't shoot in bare feet.
5. Handle archery equipment with care — do not run while holding arrows.
6. Never use inferior or damaged equipment.
7. Take care when pulling an arrow from a target. One pulled violently could cause injury to an onlooker.
8. Shooting on the range should be supervised at all times.

Check list before shooting an arrow

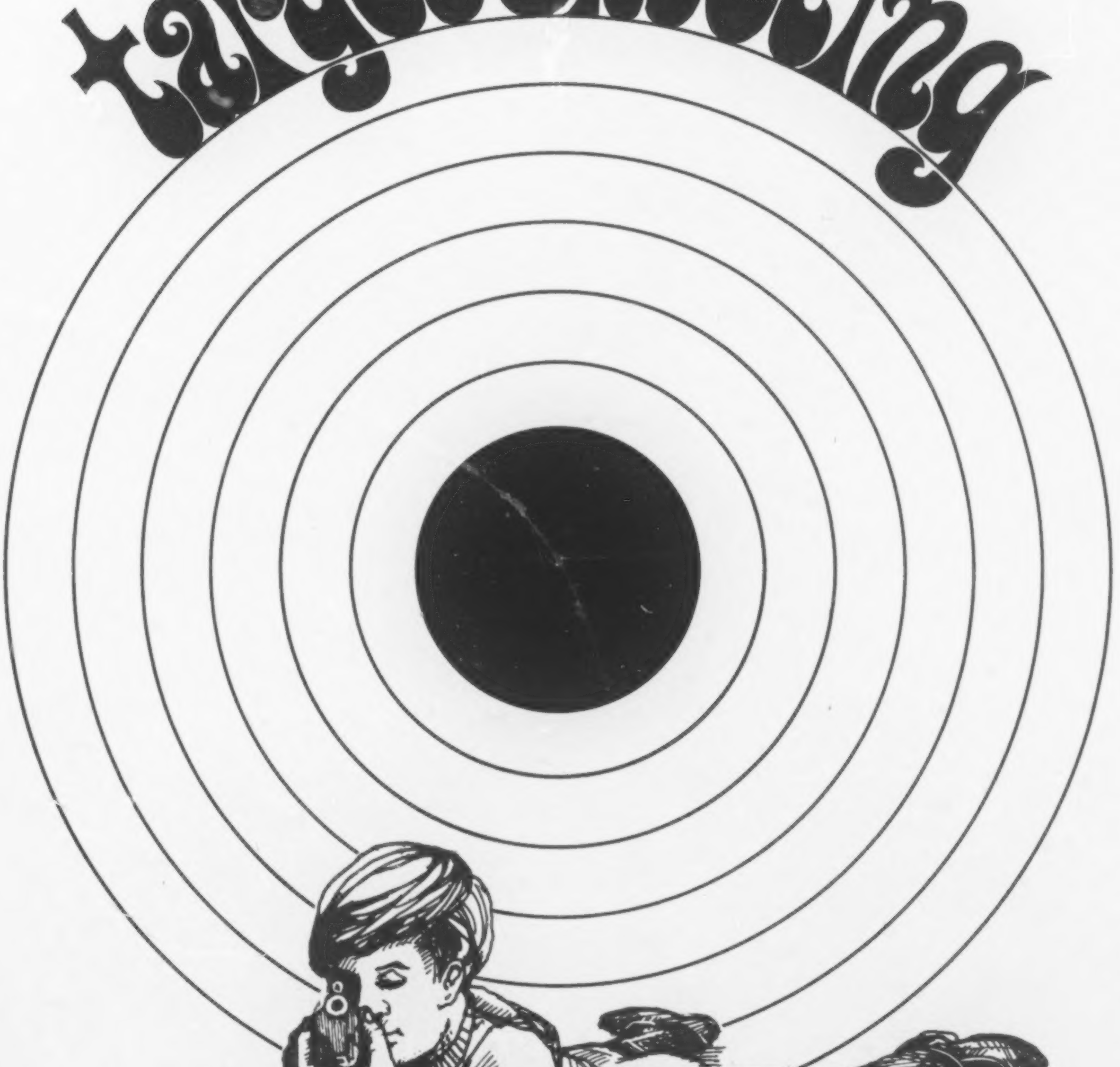
1. Stance
2. Nock Arrow
3. Bow Hand and Arm
4. Head Up
5. Raise Unit
6. Draw to Anchor Point
7. Aim — Hold
8. Aim — Release
9. Aim — Follow Through



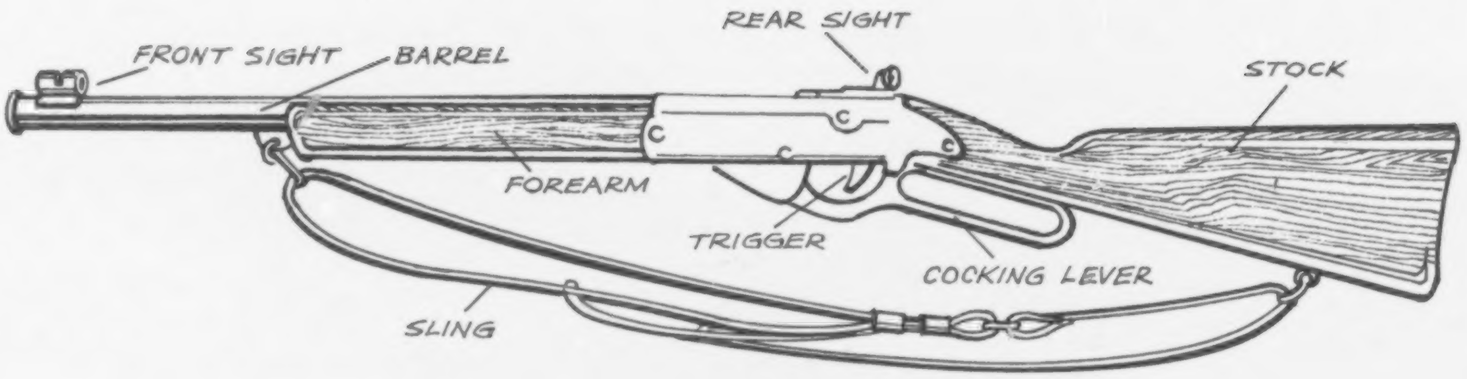
Fun Activities with Archery

1. Target shooting contest with a friend or friends. Score 5 (Bull's eye); 4 — Red; 3 — Blue; 2 — Black; 1 — White.
2. Stick a 2″ tape on target from top to bottom and shoot at it (based on Wand shooting contest).
3. Attach balloons to target and shoot at them.
4. Stick an arrow in the target and suspend from it a balloon on a 6″-8″ string. Try to burst it as it sways in the breeze. This is a real challenge to your skill.

target shooting



TARGET SHOOTING


REAR SIGHT
FRONT SIGHT
BARREL
STOCK
FOREARM
TRIGGER
COCKING LEVER
SLING

The history of firearms goes back to a description of man blowing pebbles through a hollow reed or cane with enough power to kill or stun game. The principle of the air gun is that air is compressed and released to propel a ball or pellet.

A spring and plunger is tightened and compressed by means of the cocking lever and held by a trigger. When the trigger is released, air is forced into a chamber in front of the plunger. The compressed air is driven from the chamber through a small outlet and propels the pellet.

BE FAMILIAR WITH THESE IMPORTANT RULES WHEN HANDLING GUNS

1. Treat every gun with the respect you would give a loaded gun.
2. Be sure the gun you are carrying is neither loaded nor cocked.
3. Check the gun barrel to be sure it is clean and not plugged.
4. Carry your gun so that you can control the direction of the muzzle even if you stumble.
5. Pull the trigger only when you are sighted on a safe target.
6. Point a gun only at something you want to shoot.
7. When not in use, your gun should be unloaded.
8. Never climb a tree or fence or jump a ditch with a loaded gun.
9. Never shoot at a flat hard surface or at the surface of water.
10. Always have respect for other people's property.

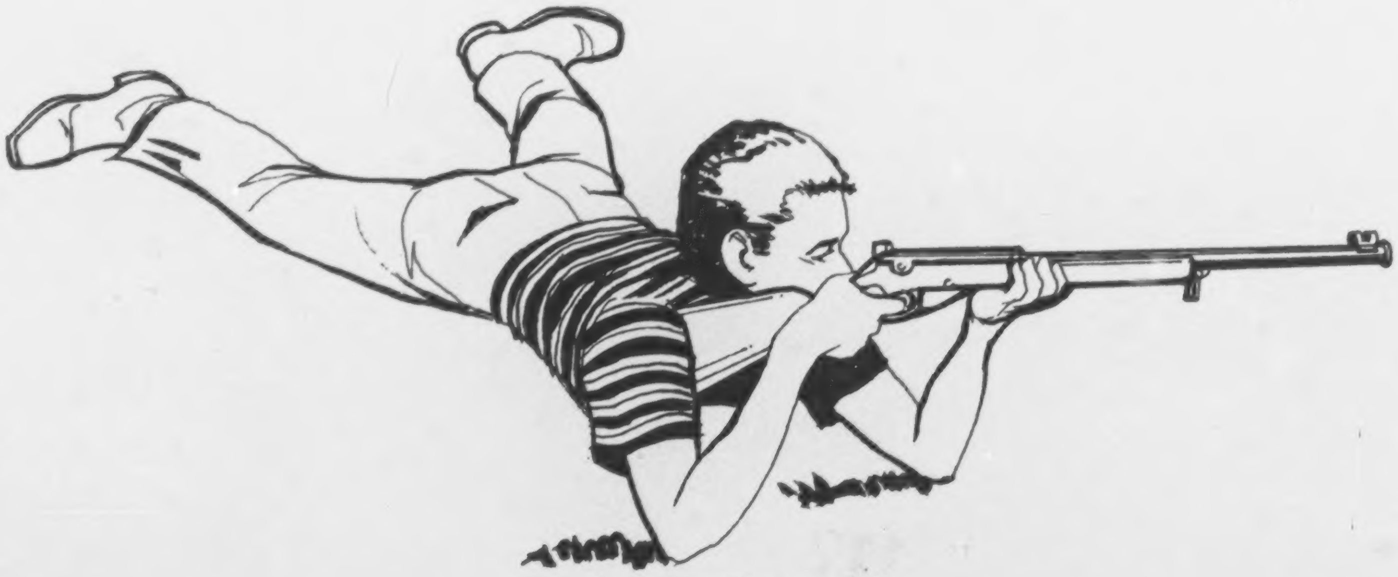
All shooters should learn to shoot first without ammunition to establish a routine and know exactly what to do with a loaded gun.

Proper shooting positions

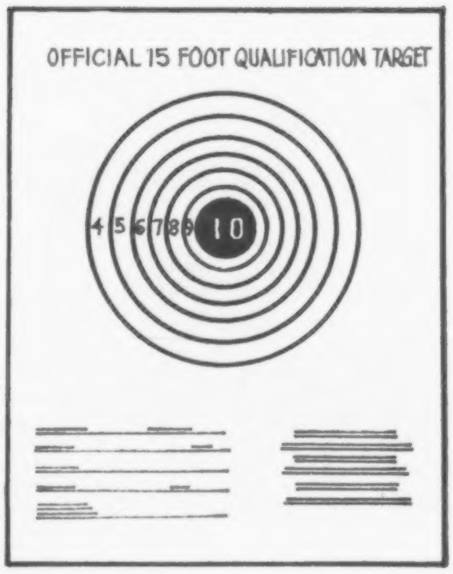
Before assuming the position, half face to the right. There is a point to which the rifle points naturally. Shift your body so that the rifle points naturally to the centre of the target.

The right hand grasps the small of the stock with the right thumb along the right side of the stock. Rest the barrel of the rifle in the palm of the left hand. The cheek should be pressed firmly against the stock for more accurate sighting.

In the prone firing position, your body will be at a 45° angle to the line of fire. Keep your back straight and your legs well spread. The insides of your feet should be as nearly flat on the ground as possible. In this position the body should be as relaxed as is comfortable.



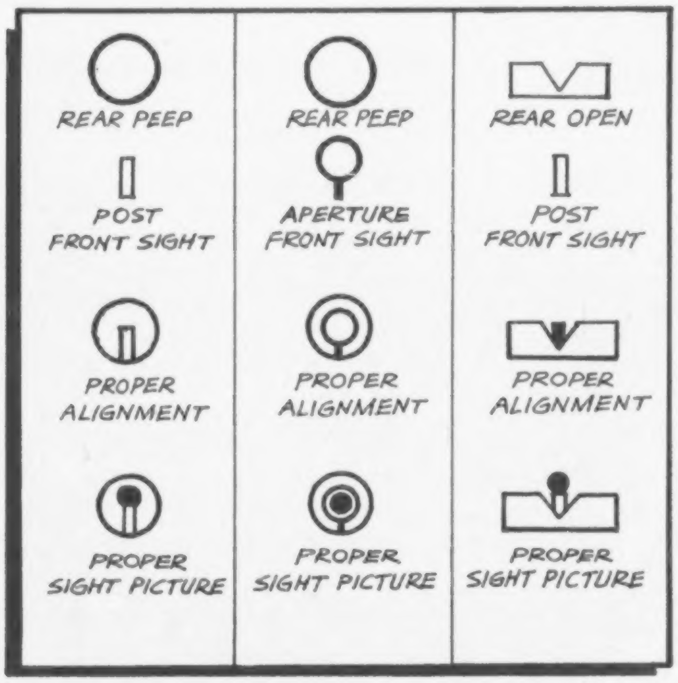
SIGHTING YOUR RIFLE


OFFICIAL 15 FOOT QUALIFICATION TARGET
4
5
6
7
8
9
10

Any good gun will shoot just where you hold it. The spring air rifle is aimed by lining the front sight with the rear sight and the target.

You will be aiming at the centre bull's eye of the target.

Below are three different kinds of sights commonly used on rifles.

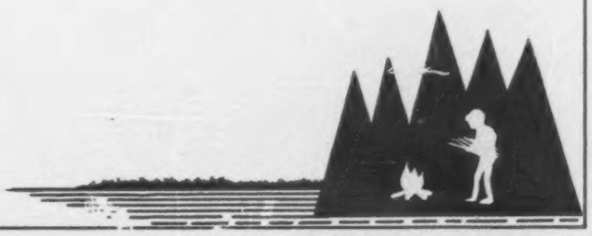

REAR PEEP
POST FRONT SIGHT
PROPER ALIGNMENT
PROPER SIGHT PICTURE
REAR PEEP
APERTURE FRONT SIGHT
PROPER ALIGNMENT
PROPER SIGHT PICTURE
REAR OPEN
POST FRONT SIGHT
PROPER ALIGNMENT
PROPER SIGHT PICTURE

Tips For Accuracy

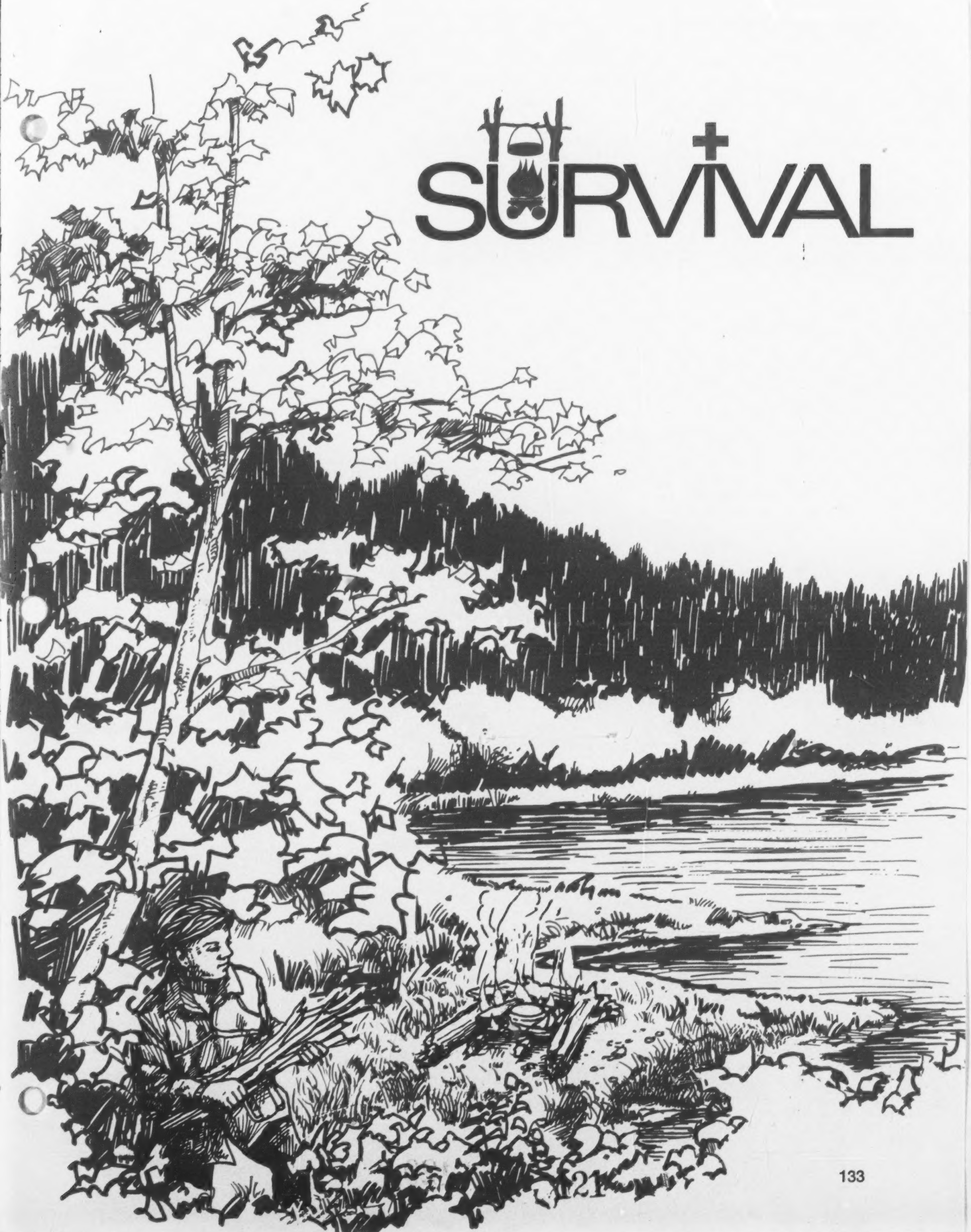
The rise and fall of your chest as you breathe causes the muzzle to move as well. If you can estimate the timing and control your breathing as you squeeze the trigger, the muzzle will remain steady. The pressure you apply to the trigger should be a slow steady movement of squeezing rather than pulling.

Continue to look at the target for a few seconds after the gun fires and then relax from the shooting position.

A Story of Survival in the Woods.



SURVIVAL



SURVIVAL

When you are lost in the woods, do not panic because you have been provided with every necessity. These are ____________________, ____________________, ____________________, and ____________________.

Thirst is the biggest problem. Man can live on water alone for over a month but without it he would only last a week. A good rule to follow is to assume all water is impure until proven otherwise. The best method of purifying it is to ____

____.

Two ways of eliminating the flat taste are

1. ____.

2. ____.

A temporary method of relieving the thirst is by ____________________

____.

Everyone appreciates a hot drink especially during the Winter months. Even in the woods these drinks are available.

1. Spruce Tea:
   This delicious drink can be made by boiling the young spruce needles. If you are hungry, eating the raw needles will add vitamin "C" to your diet.
2. Birch Tea:
   Steep the young leaves and twigs in the hot water for the tea.
3. Coffee:
   The dried roots of dandelion and chicory can be roasted and ground for a hot cup of coffee.

Having satisfied your thirst you must now find some food. A good diet should consist of ____________________, ____________________, and ____________________.

List six animals you could easily catch for your supper:

1. ____________________ 3. ____________________ 5. ____________________

2. ____________________ 4. ____________________ 6. ____________________

Name one insect which has a bitter taste: ______________________________.

Remember the rest are all edible. Describe a simple method for catching the insect:

____

____.

List six plants found in the woods which are edible:

1. ______________ 3. ______________ 5. ______________

2. ______________ 4. ______________ 6. ______________

Name two plants found in the wods that should be avoided.

1. ______________ 2. ______________

List three berries suitable for eating:

1. ______________ 2. ______________ 3. ______________

Describe three traps you could construct to capture animals:

____

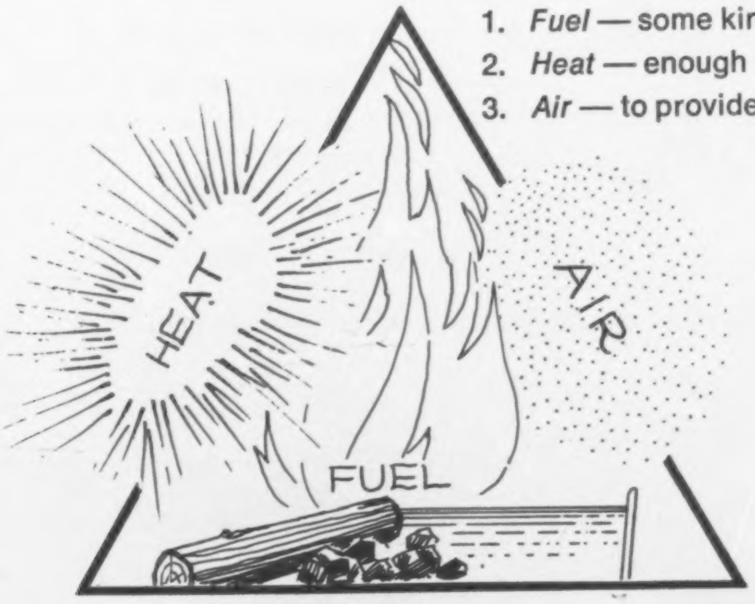
____

Easy Fire Making

The experienced camper looks for rock, gravel, or sand on which to build his fire, and then clears the ground around it of all inflammable material to make sure the fire can't spread. He should never build a fire at the base of a tree, or near enough for heat to kill the roots. He prepares tinder, kindling, and fuel, and makes exactly the kind of fire he needs. The last thing the experienced camper does, when he's finished with his fire, is to make sure every ember is out, and to clean up the fire site.

For a fire to burn, three things are required:

1. *Fuel* — some kind of material that will burn.
2. *Heat* — enough heat to bring fuel to ignition.
3. *Air* — to provide oxygen for the burning process.

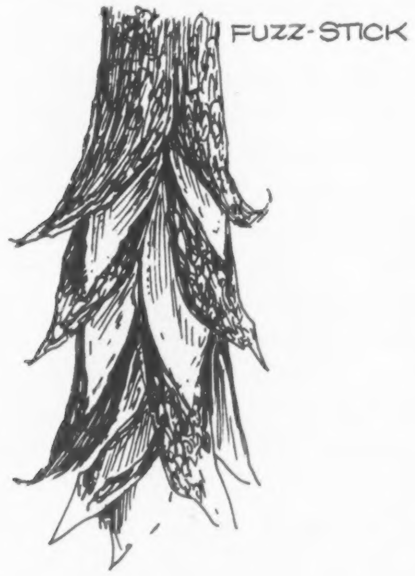


Fire Makers

The best are large wooden matches.

Natural Fire Starters

Good campers use natural tinders for fire starters. Bark from a dead tree is good. Dry weed stalks and tiny twigs from evergreen trees make good fire starters. A 'fuzz-stick' fire starter is excellent. It is whittled from a dry stick.



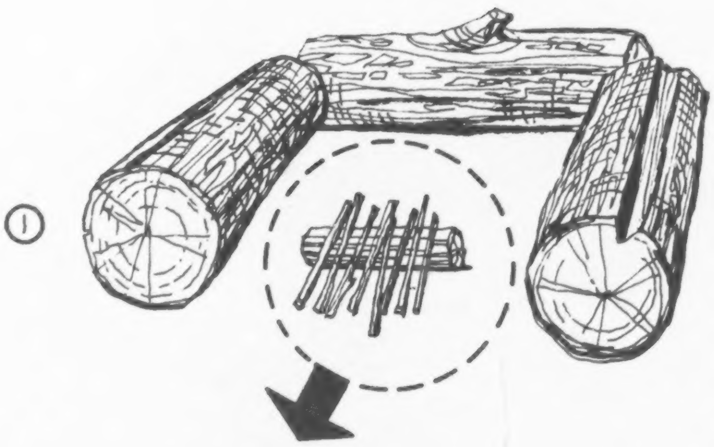
Fire Wood

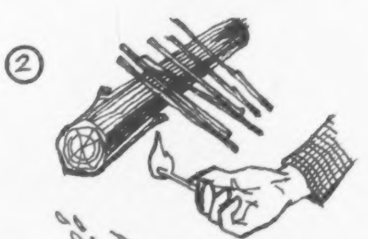
Kindling should be of good dry sticks and twigs graduated in size from pieces just bigger than tinder up to pieces as thick as a thumb, and from six to twelve inches long. Longer pieces may be split for kindling. Dead branches are good for fuel. Break the sticks into suitable lengths and sort them out — thin sticks for quick fires, thick for slow fires. Split logs burn faster than whole logs.

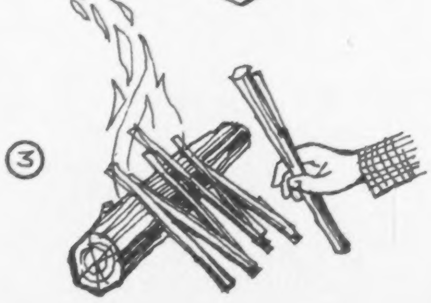
Starting A Fire — A Foundation Fire

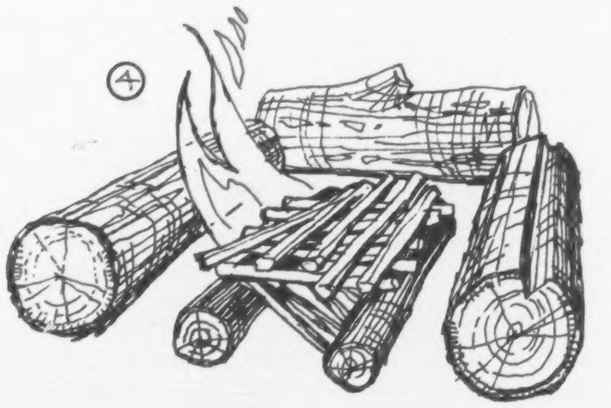
For an easy fire-lay place the 'fire stick' over two other sticks or stones, so that the wind will help the blaze by blowing through the fire when lighted. Do this by having the wind at your back, as you face the fire.

Place the tinder under the 'fire stick' as shown in A. Place thin sticks and finally somewhat larger sticks over the 'fire stick', as shown in B. Light the tinder, putting the flame under the centre of the pile of tinder, breaking the match to make certain that it is out or throw it in the fire. As the flame catches and begins to spread, add bits of tinder, placing them gently on the flame until there is a brisk fire.









Putting Out Fire

When you are through using the fire, put it out. Douse every stick with water and kill all embers. Stir up the wet mass and douse it again. Be sure it is out! If you have no water, put on sand or dirt, and stir thoroughly. When you can press your hand on the spot where the fire was you know it is out.

Firewoods

Dry wood burns better than green wood. A great amount of heat is lost in drying the water out of the green wood before the wood begins to burn. Hickory is the best wood to use. Willow is rated fair for quick and slow fires, while cottonwood is poor. The following are some hints for collecting wood. Wood for kindling should snap when broken. Tinder may be anything that is very light and dry — not to be any thicker than a match. Make little bundles of tiny twigs. Sticks that bend and do not snap are green; use this only after a hot fire is started. Wood that crumbles is rotten. It has lost all its life and will just smoulder and smoke without giving off any heat. Split wood burns well; the inside of a log is drier than the outside. Soft wood is from quick growing trees. It is good for starting fires, or for quick hot fires. It burns up quickly and needs constant refueling; it does not leave good coals. Hard wood is produced by trees that grow slowly. It is compact and firm, and feels heavy in the hand as compared with a piece of soft wood of the same size. This kind of wood burns slowly, and yields coals that will last. It needs a good hot fire to get started, and then burns well for a long time.

Firelighting

1. What is tinder? List some sources where it may be found:

____

____

____

____

2. Without a match, name three different ways to light a fire:

____

____

____

____

____

____

3. When do you use softwood and hardwood? List three examples of each:

4. Describe two different ways to build a fire:

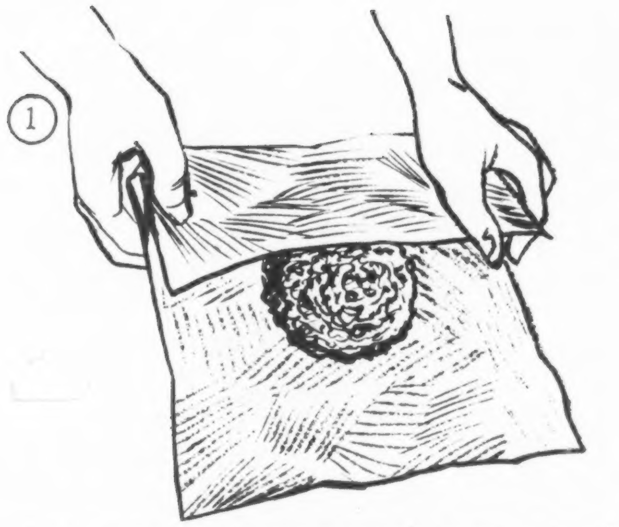
Cooking Fires

Dig a pit in the ground and place logs or rocks so that the wind will blow the length of the fire pit. Start with the foundation fire already mentioned. When the tinder is burning briskly, begin to add pieces of kindling, one by one, placing them lightly where the flame is best, starting with small pieces, and gradually adding bigger pieces, forming a teepee shape. Do not make any sudden changes in the size of wood used; add pieces that are just a bit larger than those already burning, until you are using thumb-sized sticks. Remember: build gradually, keep the fire compact, each piece of wood touching the other pieces for most of its length. Put a small stick or poker in the bottom of the fire to raise it just a little to give more air. The teepee fire is a quick, hot fire for boiling, since it concentrates the heat at a small point at the top.

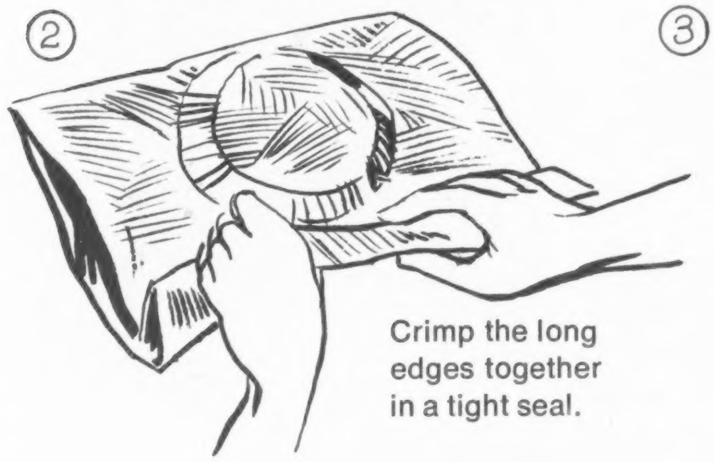
The crisscross or log cabin fire-lay quickly burns into beds of coals for broiling or produces a long-burning fire. Start with the foundation fire. Put thick sticks on either side at the bottom after the foundation fire is going well. Across these two sticks horizontally place layers of lighter sticks so that they crisscross on each other. Cut enough wood for cooking the complete meal and cut it to proper size. Remember that a fire needs air. In the beginning the fire will consist mostly of leaping flames. Make use of them for boiling purposes. After a while, if not fed further, the fire will burn into glowing embers perfect for broiling.

Aluminum Foil Cookery

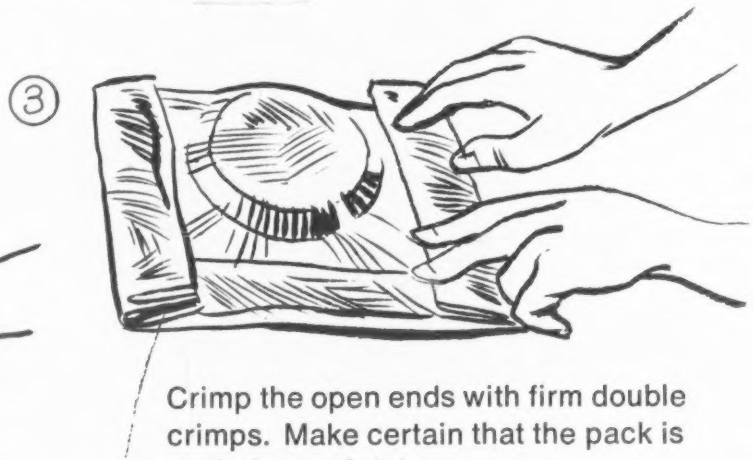
One of the smartest ways of cooking is with aluminum foil. You simply wrap the raw foodstuffs in foil, place the packages on hot coals, turn them a couple of times during the cooking, and serve directly in the foil. The fire is important in foil cookery. You need a shallow bed of glowing coals that will last for the length of time required for cooking. The quickest way to make this is to make a crisscross fire-lay and let it burn down to embers. The next in importance is the way in which you wrap and seal the food. The diagrams that follow will give you this procedure. The important thing is to make the wrapping airtight to keep the moisture in. This way you cook by steam and retain all the juices.



Tear off a sheet large enough to go around food and to allow for crimping the edges. Place food on one half of the sheet, fold the other half over it.



Crimp the long edges together in a tight seal.



Crimp the open ends with firm double crimps. Make certain that the pack is sealed completely.

Now place the foil packages directly on the coals and wait for the food to cook. Below is a cooking timetable. Be sure to turn the packages at least once, halfway through the cooking. Use a small stick for turning and do not puncture the foil.

Cooking Times:

Article	Number of Minutes	Article	Number of Minutes
Beef, Hamburger	8 - 12	Potatoes, whole	45 - 60
Beef, 1-inch	20 - 30	Potatoes, sliced	10 - 15
Frankfurters	5 - 10	Apple, whole	20 - 30
Carrots, Sticks	15 - 20	Banana, in skin	8 - 10
Corn, ears	6 - 10	Biscuits	6 - 10

When cooking time is up, take the packages out of the fire, unwrap them or make a crisscross slit in the top of the foil, open them up, and use the foil as your plate.

conclusion

What's It All About?

During your week at the Science School you had an opportunity to individually study many different areas. If this was your first learning experience using the out-of-doors as a classroom, then this was probably a good approach. However, this does not represent the true picture of life on earth. Fortunately, plants and animals are not isolated in their own little worlds; everything in nature is inter-related. No form of life can exist on this planet without assistance from other life. Thus, we would now like to draw together these isolated areas and hopefully enable you to have a more accurate concept of your environment and your role within it.

The earth is a self-contained, life-sustaining envelope containing a narrow band of usable water. These physical resources are limited in quantity and play an essential role in environment and the necessary ecological balances within it. Pesticides, noises, dirty air, polluted water, excess waste, growing population and less open land are forms of man's destruction of our environment.

All life depends upon the condition of the vital components of our environment: the air, water, soil, minerals and plants of which forests represent a very important sector, and other creatures. Since man's comfort, pleasure and survival are dependent upon his actions toward these environmental components, it is important that he be aware of the effects of his actions.

Plants and animals inhabiting a common area will have definite effects upon one another. This area or "biotic community" together with its physical environment (soil, water and air) is called an "ecosystem". The earth is made up of many ecosystems.

The pond is an excellent example of a biotic community. In this community you will find only certain kinds of plants, including cat-tails, duckweed, and elodea. Some of the main animals are fish, frogs, turtles, dragonflies, ducks and muskrats. Every one of these plants and animals depends on each other. As you study their inter-relationships you will be able to construct food chains or biotic pyramids. The study of these ecosystems to determine the relationships of the plants and animals is called "ECOLOGY".

All ecosystems require four basic elements to maintain balance:

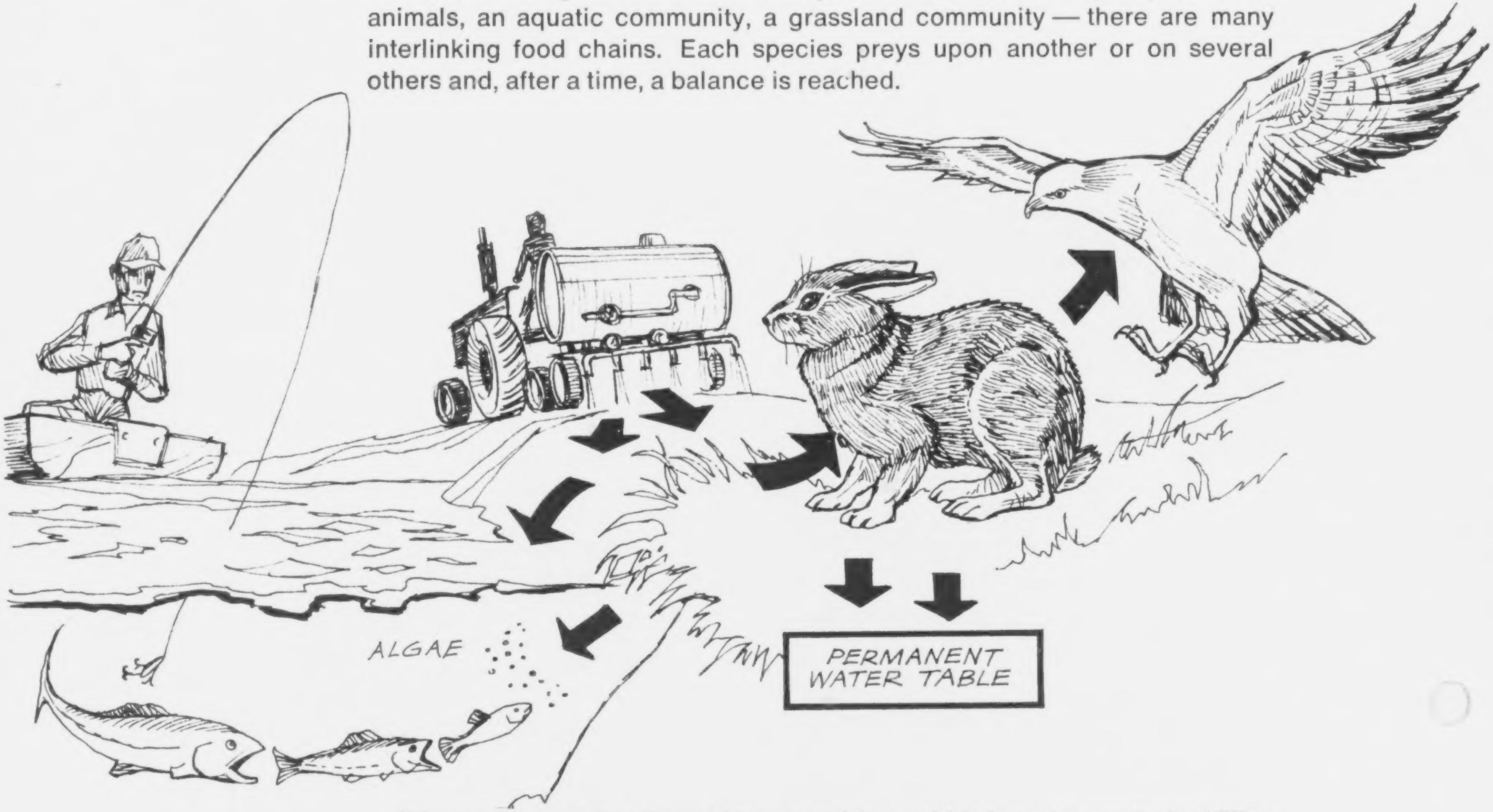
1. inorganic material (gases and minerals)
2. producers (plants)
3. consumers (animals)
4. decomposers (bacteria and fungi)

In balanced ecosystems, the populations of individual species are either very stable or fluctuate through regular, predictable high and low periods. The food chain is one of econology's most basic concepts. In effect it is a way of distributing energy from species to species — energy that originates in the sun and is converted to chemical energy by green plants through photosynthesis.

A simple example of a food chain would be: plants make protein by using the energy from the sun to combine nutrients from the soil with water and carbon dioxide. A fox eats the rabbit. The final link in the chain comes when the fox dies and is decomposed by bacteria in the soil, replenishing the nutrients to fertilize a new crop of plants.

However, food chains are not this simple in real life. A vulture may eat the dead fox and keep the protein in the animal kingdom. Maggots may also nibble at the fox, mature into adult flies and then be eaten by dragonflies, which are, in turn, eaten by birds. Foxes eat birds. So do other predators. In this way one food chain can interlink with many others. This is the web of life!

In what ecologists call a community — a forest community of plants and animals, an aquatic community, a grassland community — there are many interlinking food chains. Each species preys upon another or on several others and, after a time, a balance is reached.



It is easy to see that if man intervened in a rabbit-fox community by killing the foxes, the rabbits could multiply uncontrolled, and the plants would be eaten faster than they could grow. If the plants were killed, the soil would become bare and erosion would occur. The precious topsoil, the layer with the nutrients, would wash into the rivers. Then nothing would be able to grow in the area.

When it comes to interfering with nature, the results are usually far more extensive than first imagined. This is what ecology has revealed. For example, no one foresaw that atomic bomb tests would put radioactive stronium-90 into the atmosphere and, via the food chain, into the bones of children.

As long as environmental factors in an ecosystem remain stable, the animal populations remain stable. In many natural communities, however, the factors change very slowly, often as the plants change. A habitat can also change very slowly as a pond or lake gradually fills in from accumulating layers of sedimentation. This is called eutrophication and it is the process by which a lake grows old. (In what way would pollution speed up this process in Lake Ontario or Lake Erie?)

Over many years this can shrink a lake to a pond which then turns into a marsh and finally a dry meadow where a forest will begin. This is the process known as biotic succession. The starting point in any succession is always a pioneer community which is able to colonize and inhabit a bare surface. The end product is known as a climax community which is relatively stable and complex. This is the final group of plants and animals that can go on reproducing itself, instead of having another kind come along to take its place.

When man first crossed over the Bering Straits from Asia to populate North America, he found a community suitable to his species. As Eskimo or Indian, early man in this land respected his habitat. He lived harmoniously with it and even worshipped the creatures of the forest. It was perfectly clear to his superior brain that as long as he preserved his environment, it would take care of him.

When the early settlers came to North America there were 60 million buffalo; by 1900 there were only 21 million. The buffalo nearly became extinct but conservationists and ecologists were able to provide a suitable environment for the beast. They were successful only when they were allowed to do what ecology said the buffalo needed. Whether ecology will be given that much say in the future of man is not yet certain.

Pollution

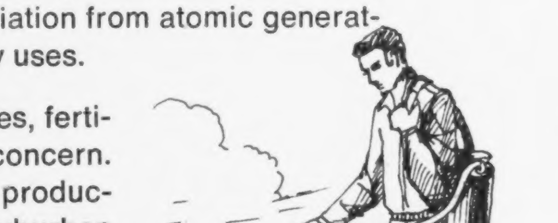
1. Air pollution is probably the most serious threat to our environment. It is a silent killer which covers every city in North America and reaches the creatures in the Arctic. It is a frightening kind of pollution that colours our skies, burns our eyes, blackens our white houses, darkens our lung tissues, corrodes metal and coats everything else in dust. But air pollution is even worse than it looks. Particles are the only pollutants you can see. The deadly gases are invisible. It is suspected that air pollution is a major factor in causing lung cancer.

   Automobile exhaust is by far the greatest polluter, followed by home heating, industry and the burning of garbage. This is the worst kind of pollution since once it is in the atmosphere man is helpless and thus must rely on nature to purify it. Unfortunately, this usually means washing it down to our land where it goes into our rivers and on the seas.

2. Water Pollution — Water flows through all of the problems facing man and his environment. Water, essential to life, is quickly becoming a conveyor of death. Virtually every stream, river and lake in the country is polluted to some degree. The Great Lakes are becoming dirtier every year with Lake Erie the worst and Lake Ontario next. The once great commercial and sport fishing industry in Lake Erie is dead.

   Water pollution takes many forms: Municipal wastes and industrial affluent; pesticides and fertilizer runoff from agricultural operations; heat released through cooling operations; radiation from atomic generating plants; and chemical disposal from military uses.

3. Soil Pollution — The improper use of pesticides, fertilizers and herbicides is a new and increasing concern. Also, land has many values in addition to food production. Every day airports, highways and suburban developments consume hundreds of acres of land, lost forever as green space, wildlife habitat and recreation areas.



Summary

The quality of our environment is a major concern to all of us. Ecology is also a way of understanding our modern world. Everyone is talking about it but why don't you do something about it? That's what ecology is all about!

FOLLOW-UP ACTIVITIES

The Forest Community

A forest community is a natural area in which the various living things depend upon each other just as we in our communities depend upon others for our food and shelter.

If a natural area is left alone, the number of individuals of each kind of plant and animal remains about the same. This is called "Balance in Nature".

1. Below are listed types of animals which help to maintain the Balance in Nature. Name an example of each.

predator ______________________ parasite ______________________

herbivore ______________________ scavenger ______________________

carnivore ______________________

2. Give three ways man upsets the Balance in Nature.

1. ____

2. ____

3. ____

3. Give three natural disasters that upset the balance.

1. ______________ 2. ______________ 3. ______________

4. See how many food chains you can make from the following:

cow mouse robin seeds mink insect
man fox grass hawk cherries woodpecker

What Can You Do?

1. a. Set up a balanced aquarium in your classroom.
   b. Add measured quantities of oil, fertilizer, or other wastes and observe.
   c. What would happen if the fish population increases?

2. a. If possible, purchase a commercial detection kit to test local streams for pollution.
   b. Can you find the source of pollution?

3. a. Why is water pollution an international problem? ✓

4. a. Find an ant colony in the schoolyard.
   b. If possible, set this up in the classroom.
   c. Take a population count.
   d. Observe how they work together.
   e. Can you upset this colony by introducing red ants?

5. a. Is the area where you live a biotic community?
   b. What animals live there?
   c. Can you construct a food chain for these animals?

6. a. Did these animals always live there?
   b. What other animals may have lived there?
   c. Why would they move?

7. a. Are wolves bad animals?
   b. Why?

8. a. What would this world be like if there were no insects?

9. a. Are there street gangs in your area?
   b. Why do they fight other gangs?
   c. Did you observe any animals fighting on the island?
   d. Why were they fighting?

10. a. Place sterilized dishes of gelatin around your neighbourhood and observe regularly.
    b. Explain any changes.
    c. Would the weather affect these changes?

11. a. From the island you were able to see a dark cloud over the city.
    b. What was causing this cloud?
    c. What is the city doing to prevent this?

12. a. Is there such a thing as noise pollution?
    b. How could it affect you?

13. a. Using a hula hoop as the boundary, examine the life in the school yard, garden, park, and woods.
    b. Why would different animals live in different areas?

14. a. Can you name one animal which lives in all parts of the world, including the arctic, desert, tundra, swampland, plains, forest, and even the ocean?
    b. Why is man the only creature able to adapt to every environment?
    c. If you were to visit a person of your own age in another country, what differences would you find between the way you live and the way your friend lives?

15. a. What are the properties of your environment without which you could not live?

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New York: Random House, 1957.

Tilden *Interpreting Our Heritage.*
Chapel Hill Publishers, University Of North Carolina Press, 1967.

Magazines

National Wildlife Federation: 381 West Centre Street, Marion, Ohio, 43302.

Ranger Rick: c/o National Wildlife Federation.

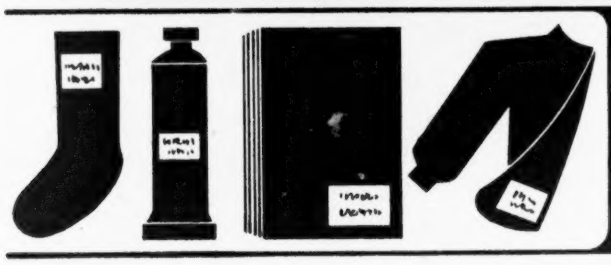
Young Naturalist: Federation Of Ontario Naturalists, Don Mills, Ontario.

EQUIPMENT LIST

Island Outdoor Science School

Use this as a checklist before leaving home,
and also before leaving the school

Home	Camp	Essential Items	Home	Camp	Optional Items
		Clothing 1 pr. pajamas underwear for a week 1 pr. walking shoes 1 pr. overshoes for wet weather socks for a week 2 pr. jeans or heavy pants 1 warm jacket (waterproof if possible) 2 warm shirts handkerchiefs for a week 1 hat or scarf for head 1 pr. warm mittens 1 scarf			bathrobe shower cap for girls camera and film books games, such as chess, checkers, cards, etc.
		Toiletry Items 2 towels comb toothbrush toothpaste facecloth Writing Material paper, envelopes, pencil, **stamps**			**Do Not Bring** knives radios comic books candy gum money



Clothing and articles should be labelled clearly with the child's name.

The school cannot be responsible for any articles lost or missing during a pupil's visit.